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WHITE'S
NEW COURSE IN ART INSTRUCTION

MANUAL
FOR
FIFTH YEAR

NEW YORK · CINCINNATI · CHICAGO
AMERICAN · BOOK · COMPANY ·

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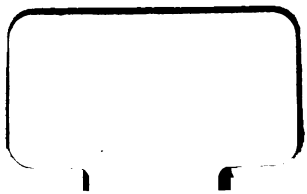

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WHITE'S NEW COURSE IN ART INSTRUCTION

MANUAL

FOR

FIFTH YEAR GRADE

INCLUDING

AN OUTLINE OF THE YEAR'S WORK

WITH SUGGESTIONS FOR TEACHING

NEW YORK ·:· CINCINNATI ·:· CHICAGO ·:· BOSTON
AMERICAN BOOK COMPANY

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WHITE'S

NEW COURSE IN ART INSTRUCTION.

INTRODUCTORY.

WHITE'S NEW COURSE IN ART INSTRUCTION is not the result of one person's thought; nor was it, primarily, a commercial venture. It embodies the ideas of many, who, starting at widely separated points and working individually along different lines, arrived almost simultaneously at the same conclusions.

In some respects the course differs from all others. Its chief points of departure are as follows: —

I. **Its plan** is based on an analysis of the entire subject of Art Instruction, from which have been derived the divisions of the work and the outline of each division. These divisions are natural and not artificial, and are such as are justified by established usage.

II. **Its method** is determined by the laws of the mind, upon which depend all correct principles of teaching. For example:

(*a*) The object to be known must itself be present to the mind: hence, in this course models and objects take the place of pictures to be copied.

(*b*) The mind develops through its own activity: hence, no guide points or construction lines are given.

(*c*) In developing, the mind acts according to certain recognized laws: hence, the various departments of drawing are

logically arranged, that the mind may pass naturally from one to another until the whole is known.

(*d*) While acting according to general laws, each mind has individual peculiarities which affect its growth: hence, while general principles are tenaciously adhered to, great freedom is allowed in the application and expression of these principles.

(*e*) The most rapid and substantial development of mind occurs under intelligent guidance: hence, illustrative material is given in abundance to guide the pupils in discovering principles, laws, conventional signs, styles of handling, etc.

III. **Its aims** are, first, to acquaint pupils with the rudiments of all kinds of drawing included under the two departments, mechanical and freehand, for the two are equally important, — one underlying all the industrial arts, and the other all the fine arts; therefore, provision is made for the related development of these two departments from the lowest grade throughout.

Secondly, to lead pupils to feel that, while art and love for the beautiful may be fostered by an artistic and beautiful environment, skill and power and quick original perception of beauty come only through faithful and persistent practice in drawing; for this reason correct proportions, accurate measurements, exact truthfulness in drawing are considered of chief importance, while pencil-holding, broadness and grayness of line, and suggestiveness are relegated to second place.

And, thirdly, to develop a love for the beautiful in nature and in art. By the comprehensive study of color and form, it leads to mineralogy and other natural sciences; through historic ornament, to mythology, ancient history, and historic art of all kinds; through plant-form, to botany and original design; through model and object drawing, to pictorial art; and through the different divisions of geometric drawing, to manual training and all the manifold constructive arts.

IV. **Its order of lessons** is therefore determined. The lessons follow a definite plan, are outlined according to a good method, and have certain ends in view. On this account their order

should not be changed, unless the teacher can prove that such changes are in accordance with sound pedagogical principles.

The teacher of each grade should be familiar with the work of other grades, that the lessons may be progressive from grade to grade. The entire

GRAMMAR COURSE

is, therefore, here outlined to show the relation of the various divisions.

Pupils should enter the grammar grades with a knowledge of color, form, and arrangement, that their chief attention may be given to representation, or drawing.

Drawing may be Geometric, Decorative, or Pictorial in character, according to the class of facts represented. That drawing in which the actual form and structure of artificial objects are represented is *Geometric.* That in which the enrichment, or decoration, of artificial objects is represented, and that which represents units, or motives, of design, whether natural or artificial, is *Decorative.* That in which the forms of objects are represented as they appear from one point of view is *Pictorial.*

A thorough understanding of geometric drawing demands a knowledge of measurement, geometry, projection, and development. A just appreciation of decorative drawing requires some knowledge of color, historic ornament, plant form, and design; and, if the pupil is to apply his knowledge of color in design, facility in paper cutting is necessary. Accurate knowledge of pictorial art and appreciation of its artistic qualities are gained by a study of the principles underlying the representation of geometric solids, and the application of these principles in the representation of natural and manufactured objects.

The grammar course, therefore, includes a study of

Measurement,	Color,
Geometry,	Historic Ornament,
Working Drawing,	Botanical Drawing,
Development,	Design,

Paper Cutting,
Model and Object Drawing.

OUTLINE OF A LOGICAL COURSE IN ART

GRADE OR YEAR IN SCHOOL	GEOMETRIC DRAWING.			
	MEASUREMENT.	GEOMETRY.	WORKING DRAWING.	DEVELOPMENT.
IV.	Use of Ruler. $\frac{1}{8}''$	Classification of Rectilinear Figs.	Representation of Curved Surfaces.	Equal Plane Faces at right angles.
V.	Use of Ruler. $\frac{1}{16}''$	Classification of Curvilinear and Mixtilinear Figs. (Instrumental.)	Representation of Curved and Plane Faces.	Unequal Plane Faces at right angles.
VI.	Drawing to Scale. Half size. Quarter size.	Simple Geometric Problems.	Representation of Invisible Parts. Plane Faces oblique in one view.	Plane and Curved Faces combined.
VII.	Drawing to Scale. $1\frac{1}{2}'' = 1'$	Construction of Polygons.	Plane Faces oblique in one and two views. Three views.	Plane Faces at oblique angles.
VIII.	Drawing to Scale. $\frac{3}{4}'' = 1'$	Inscribing and Circumscribing.	Plane Faces oblique in two or more views. Sections — parallel.	Radiating Flats.
IX.	Drawing to Scale. $\frac{1}{2}'' = 1'$ $\frac{1}{4}'' = 1'$	Advanced Problems. Tangents.	Sections — oblique. Intersections.	Truncated Radiating Flats.

INSTRUCTION FOR GRAMMAR SCHOOLS.

DECORATIVE DRAWING.					PICTORIAL DRAWING.
COLOR.	HISTORIC ORNAMENT.	BOTANICAL DRAWING.	DESIGN.	PAPER CUTTING.	MODEL AND OBJECT DRAWING.
Classification by Values. Scales of Color. Dominant Harmony.	Modified Geometric Units.	Drawings of Seeds, Buds, Fruits.	Modification of Regular Geometric Units. Contrast. Unity. Strength.	Mixtilinear Forms.	***Effect of Distance and Level.*** Representation of Solidity.
Classification by Values (cont.) Scales of Color. Dominant Harmony.	Modified Bilateral Units.	Leaves — entire-margined.	Modification of Bilateral Units. Variety. Rhythm. Repose.	Bilateral Forms.	***Foreshortening.*** Effect of Level.
Classification by Composition. Simple and Binary Colors. Complementary Harmony.	Conventional Plant Forms on radial main lines.	Leaves — serrate, notched, and lobed. Flowers.	Growth. Strict Conventionalization of Plant Forms.	Radial Forms.	***Foreshortening Reviewed.*** Concentric Circles. ***Convergence.*** *a.* One set of retreating edges bounding a vertical plane. *b.* One set of retreating edges bounding a horizontal plane.
Classification by Composition (cont.) Simple and Binary Colors. Analogous Harmony.	Conventional Plant Forms on bilateral main lines.	Compound Leaves.	Growth. Free Conventionalization of Plant Forms.	Radial Forms (cont.) Surface Patterns.	***Convergence (cont.)*** Two sets of retreating edges. *a.* At equal angles. *b.* At unequal angles.
Classification by Qualities. Natural and Acquired. Analogous Harmony (cont.)	Conventional Ornament on bilateral main lines.	Sprays.	Growth. Conventionalization of Sprays.	Original Forms.	***Use of Diagonals.*** *a.* To test work. *b.* To find centers.
Classification by Qualities (cont.) Effects of Juxtaposition. Perfected Harmony.	Conventional Ornament on balanced main lines.	Whole Plants.	Growth. Conventionalization of Plants.	Original Forms.	***Relation of Axes.*** *a.* To entire mass of solid. — Ovoidal. *b.* To one face of solid. — Conical. *c.* To two faces of solid. — Cylindrical. *d.* To all edges of solid. — Pyramidal.

The outline on pages 12 and 13 presents the entire grammar course in its simplest form.

Each vertical column shows the analysis of one of the ten divisions of representation. The Roman numerals at the left indicate the years of school life, and each horizontal line marks the program in drawing for that year. The drawing books are arranged in accordance with this plan.

The teacher should familiarize himself with the foregoing outline, and refer to it frequently, so that he may be able to teach better that part of it prescribed for the particular grade he is then teaching.

A careful study of the foregoing tabulated outline will reveal the connection between subjects in each grade and their relations to those of other grades. For example: In the fifth year, the accuracy required in measurement prepares the pupil to work out problems in development. The instrumental work in connection with geometry leads to the construction of enclosing forms in design. The type solids used in working drawing to furnish facts, also furnish the appearances required in pictorial drawing. The entire-margined leaves are usually bilateral, and their subtle curves, so harmoniously related, inspire the pupil and guide him in modifying bilateral units.

Thus each subject supplements others in the grade. The study of each subject is logically pursued throughout the grades; for example, the analysis of the rectilinear figures studied in the fourth grade, and of the curvilinear figures in the fifth, leads to the discovery of simple geometric problems in the sixth, by the use of which polygons are constructed in the seventh year. These polygons, combined concentrically in the eighth year, furnish problems in inscribing and circumscribing; combined eccentrically in the ninth, they furnish problems in tangents.

All the divisions are similarly outlined, and the lessons under each are arranged to lead the pupil step by step to the complete knowledge of the subject.

MATERIALS.

To secure the best results, each class should be supplied with the following materials: —

Models. White's drawing models, sets Nos. 2 and 3, prepared especially for this course.

Objects. As called for in the course. So far as possible, each pupil to furnish his own.

Drawing Books. White's New Course in Art Instruction, one number each year.

No. 4, for fourth year in school.
No. 5, for fifth year in school.
No. 6, for sixth year in school.
No. 7, for seventh year in school.
No. 8, for eighth year in school.
No. 9, for ninth year in school.

Drawing Paper. Good quality, sheets 9″ × 12″. That manufactured by the American Book Company is preferable.

Development Paper. "Oak tag" of medium weight, in sheets 9″ × 12″.

Colored Papers. White's educational colored papers are required to complete the work in color, as outlined in this course.

Package No. 4, for fourth year.
Package No. 5, for fifth year.
Package No. 6, for sixth year.
Package No. 7, for seventh, eighth, and ninth years.

Tracing Paper. Tissue paper of good quality will do, although the tracing paper used by designers is preferable. One sheet, 9″ × 12″, will be required by each pupil every year.

Pencils. These should be of good quality and medium hardness.

Erasers. Flexible, elastic erasers are the best.

Rulers or Scales. For the fourth and fifth years, Bradley's industrial drawing scales are recommended. For the sixth, seventh, eighth, and ninth years, Bradley's drawing scales, or architects' triangular scales, will be found most satisfactory.

Compasses. White's patent drawing compasses, with pencil.

Scissors. If possible, each pupil should have a pair of sharp four or five inch, steel scissors of fair quality.

Glue. Each pupil should have a bottle of liquid glue, for constructing designs and objects from developments.

Each pupil should be held responsible for the condition of his own materials.

OUTLINE OF FIFTH YEAR'S WORK.

(SECOND GRAMMAR YEAR. — DRAWING BOOK V.)

NOTE. — A compact outline of the year's work is first presented, in which only essential directions and references to pages and figures in the drawing book are given, to make clear what is required. Detailed directions and suggestions are added under another heading.

1. GEOMETRIC DRAWING.

I. MEASUREMENT.

Preliminary work:

Drill in use of ruler; review measurement of distances involving the use of $\frac{1}{8}''$; teach $\frac{1}{16}''$; give practice in judging distances.

All this work is to be taken in connection with the other lessons in Geometric Drawing. (See page 25.)

II. GEOMETRY.

(Draw all work accurately with ruler and compasses.)

Preliminary work:

Review Geometric Figures and their details, as outlined on page 23.

Practice use of compasses.

Practice lessons for page 3, on manilla paper.

Page 3. Geometric Figures and Applications.

a. Draw margin lines $\frac{1}{2}''$ from the edges of the page. (Unless otherwise specified, the margin lines should always be $\frac{1}{2}''$ from edges of page.)

b. Divide the space into six equal parts (nearly square).

1. Find the center of the upper left space by means of diagonals, drawing only short lines intersecting in the center. With this point as center, and a radius of $1\frac{3}{16}''$, describe a circle. Add a diameter, radius, and chord. Name all the parts.

2. Find the center of the upper middle space. Through this point draw a horizontal $2\frac{5}{8}''$ long. This line is to be the long diameter of an ellipse $1\frac{7}{8}''$ wide. Draw the short diameter. Obtain points in the ellipse by means of a strip of paper or cardboard, about $2'' \times \frac{1}{4}''$. Mark one end of this strip *e*. From *e* point off one

half the length of the short diameter, marking it *f*, and one half the length of the long diameter, marking it *g*.

Place this strip on the drawing so that point *g* is on the short diameter, and point *f* on the long diameter, and mark a point on the page at *e*. This is one point in the circumference of the ellipse. Any number of points may be found by altering the direction of the strip, taking care to keep *g* always on the short diameter and *f* always on the long diameter. Through the points thus found, draw the ellipse. Find the foci by placing the strip with point *e* upon the end of the short diameter and point *g* upon the long diameter; then mark the two points upon the long diameter. (See Illustrated Definitions, page 106.) Name all the parts.

3. Through the center of the upper right space, draw a vertical $2\frac{1}{16}''$ long. On this line as axis, draw an oval composed of a semicircle and half-ellipse. Radius of semicircle, $1\frac{1}{16}''$.
4. In the lower left space, draw some object based on the circle.
5. In the lower middle space, either draw some object based upon the ellipse, or draw a crescent (Fig. 38) and a lens (Fig. 39).
6. In the lower right space, draw some object based upon the oval.

Page 4. Ornamental Geometric Figures.

a. Draw margin lines.

b. Draw a vertical $3\frac{1}{4}''$ from the left margin line. Draw a horizontal, dividing this space into two equal parts.

1. In the upper space, draw a quatrefoil.
2. In the lower space, draw a trefoil.
3. In the remaining space, draw an original inclosing form for a radial design. (For suggestions, see page 7 of the drawing book.)

III. WORKING DRAWINGS.

(To be drawn with ruler and compasses.)

Preliminary work:

Review the representation of visible outlines.

Review front view and top view. (See page 34.)

Review use of full and dotted lines.

Teach *use of dot-and-dash lines*, to represent center lines or axes of objects.

Make freehand sketches, on manilla paper or blackboard, of two views of the hemisphere, cone, cylinder, cube, square prism, and square plinth, and of similar objects. After the principles of the representation are fully understood by the pupils, draw accurately, with instruments, in the drawing book.

Page 5. Principle: The representation of visible outlines and edges.

a. Draw margin lines.
b. Divide the space into two equal parts, by means of a vertical line.
1. In the left space, draw two views of a hemisphere, cone, or cylinder.
2. In the right space, draw two views of some object similar to the type solid drawn on the page; *e.g.*, an oil-feeder, saucer, tunnel, salt shaker, pepper box, rolling pin, or large ink bottle.

Page 6.

a. Draw margin lines.
b. Draw a light horizontal line $2\frac{1}{2}''$ above the lower margin line. This line will mark the position of the lowest line of each side view or elevation to be drawn.
1. In the center of the space, draw two views of a square prism standing upon one square face, one side being visible in elevation. Draw this side $4''$ high, and the other dimensions in proportion.
2. At the left of the square prism, draw two views of a cube or square plinth.
3. At the right of the square prism, draw two views of some object similar to one of the type solids drawn on the page; *e.g.*, a box, letter block, oil or varnish can.

IV. DEVELOPMENT.

(To be drawn with ruler.)

Preliminary work:

Make freehand sketches of the flats of all type solids which illustrate the conditions, either upon practice paper, blackboard, or both. Then draw accurately in the book. (See page 39.)

Page 9. Condition: Unequal plane faces at right angles.

a. Draw margin lines.
1. Develop the surface of a square prism or square plinth.
2. Indicate the laps.
3. Draw the flat on development paper; construct.

Page 10. Application.

a. Draw margin lines.
1. Develop the flat of a cardcase (Fig. 6, page 8); or of some other simple object, based on a square prism or square plinth.
2. Indicate the laps.
3. Draw the flat on development paper; construct: reserve for ornamentation later.

2. DECORATIVE DRAWING.

V. BOTANICAL DRAWING.

Preliminary work:

Make collections of entire-margined leaves, study them, and sketch them on manilla paper and blackboard. This material can be advantageously used for language lessons.

Page 11. Entire-margined Leaves.

a. Draw margin lines.

b. Divide the space into two equal parts, by means of a vertical line.

1. } Draw two of the following leaves, one in each space: plantain,
2. } smilax, cat brier, smilacina, ripple grass, lilac.

Page 12.

a. Draw margin lines.

1. } Draw any two of the following leaves, arranging them gracefully
2. } on the page: calla, pickerel weed, sagittaria, peltandra, or any other entire-margined leaves available.

VI. COLOR.

Preliminary work:

Review the key colors of the spectrum standard chart. The pupil ought to recognize and name any of these without hesitation.

Continue to teach *classification by values.*

Practice selecting tints and shades from dictation. Arrange scales of color. Discover scales of color in natural objects. Use this material in language lessons. (See page 42.)

Page 17.

On this page, make scales of color, using colored papers. These scales may be made in the form of concentric squares or circles, graduated in size and tone.

VII. HISTORIC ORNAMENT.

Preliminary work:

Review arrangements, and modification of regular geometric units. (See Book IV.)

Teach *modification of bilateral units:* (1) by cutting paper; (2) by drawing on blackboard; (3) by studying Book V., pages 14 and 19. Compare the units on the pages; discuss beauty of form. (See page 49.)

Page 15. Bilateral Units.

a. Draw margin lines.

b. Divide the space into two equal parts by means of a vertical line.

1. Draw Fig. 13.
2. Draw Fig. 19, 20, 22, or 24.

Page 16.

a. Draw margin lines.
b. Divide the space into two equal parts by means of a vertical line.
c. Fold the leaf so that the left half of page 16 is visible when the book is open to page 14. (Or draw first on practice paper.)

1. Draw Fig. 16, 21, or 23.
2. Select a pleasing color, cut the unit drawn, and mount it upon the right half of page 16.

VIII. DESIGN.

Preliminary work:

Review Historic Ornament and work of previous year in Design, including the *principles of design* — contrast, unity, strength.

Teach the principles — *variety*, *rhythm*, *repose*. This can be accomplished

(1) by cutting paper designs; (2) by drawing upon the blackboard; (3) by studying the illustrations in the drawing book. (See page 53.)

Page 18. Original Bilateral Units.

a. Draw margin lines.
b. Divide the space into two equal parts, by means of a vertical line.

1. Draw an original bilateral unit, based on Fig. 35 or Fig. 36. (The vertical axis should be at least 4″ long.)
2. Draw an original bilateral unit, based on Fig. 36, modified in proportions (like Fig. 43 or Fig. 45); or on Fig. 37.
3. Draw an original bilateral unit, based on Fig. 34. Then cut it from colored paper, and use it to ornament the paper box or cardcase, constructed in a previous lesson.

Page 21. Design from Copy.

Upon this page, copy two of the borders given on page 20; or copy one border and construct it, using colored paper, illustrating dominant harmony; or copy a center, or one of the surface patterns. Lay out the design accurately. Use tracing paper to transfer units after the first is correctly drawn. Finish with clean gray lines; the half-tinting should be *very* light.

Page 22. Original Design.

This page may be filled in one of four ways:

a. Draw an original border, using bilateral units, upon the upper part; construct it with colored paper below. Or,
b. Draw an original center upon the left half of the page; construct it with colored paper upon the right. Or,

c. Lay out an original surface pattern, covering the entire page. Draw one half; construct the other half with colored paper. Or,

d. Construct with colored paper an original border, center, or surface.

IX. PAPER CUTTING.

(See suggestions, pages 63–68.)

3. PICTORIAL DRAWING.

X. MODEL AND OBJECT DRAWING.

(To be entirely freehand.)

Preliminary work:

Continue practice in seeing with one eye; seeing masses; using wire. Teach *proportional measurement:* (*a*) proper position of pencil; (*b*) sighting one point; (*c*) sighting two points; (*d*) comparing two distances; (*e*) representing the proportions of distant objects.

Page 23. Foreshortening.

a. Draw margin lines.

1. Draw the picture of a hemisphere resting upon a plane surface, the representation of the hemisphere to be at least 6″ in width.

Page 24.

a. Draw margin lines.

b. Divide the space into two equal parts, by means of a vertical line.

1. Draw the picture of a cone standing upon a plane surface.
2. Draw the picture of a cylinder standing upright upon a plane surface.

Page 27. Applications.

a. Draw margin lines.

1. Draw some hemispherical object; *e.g.*, a bowl, saucer, half-apple, etc.

Page 28.

a. Draw margin lines.

b. Divide the space into two equal parts, by means of a vertical line.

1. Draw two objects, one conical, one cylindrical; *e.g.*, a cornucopia, tunnel, glass, cuff, cuff box, etc.

Page 29. Applications. — Group.

Upon this page, draw some simple group of objects, similar to those shown on page 26. Select those objects only which are based on some type already drawn. Do not combine incongruous objects. Try to arrange a group which shall tell a story.

Page 30. Original Group.

1. GEOMETRIC DRAWING.

Geometric Drawing deals with the actual form and structure of objects. It includes *Measurement*, to determine and represent size and proportion; *Geometry*, to determine and represent underlying structure and relation; *Working Drawing*, to represent solid form; and *Development*, to obtain superficial area.

Geometric Drawing should be accurate. Mechanical aids — the ruler and compasses — are indispensable. The last results, however, may be obtained only when Geometric Drawing is preceded by a careful study of solid forms, and freehand representation of their planes: hence, the first work in the fifth year grade should be a review of form.

GENERAL REVIEW OF THE STUDY OF FORM.

A. — Solids.

1. Curvilinear
   - Sphere.
   - Spheroids
     - Flat.
     - Long.
   - Ovoid.

2. Mixtilinear
   - Hemisphere.
   - Cylinder.
   - Half-cylinder.
   - Circular Plinth.
   - Cone.

3. Rectilinear
   - Cube.
   - Prisms . . . .
     - Triangular.
     - Square.
   - Square Plinth.
   - Square Pyramid.

B. — Geometric Figures. *Represent plane faces.*

1. Curvilinear { Circle, Ellipse, Oval } { Circumference. Arc. Center; foci. Diameter. Axis. Radius.
2. Mixtilinear { Semicircle. Quadrant.
3. Rectilinear { Triangles { Base. Altitude. Apex. Scalene (right-angled), Isosceles, Equilateral. Quadrangles { Diagonal. Diameter. Square, Oblong, Rhombus, Rhomboid.

C. — Lines. *Represent outlines or edges.*

1. Lines { Curved { Circular. Elliptical. Oval. Straight.
2. Position { Horizontal. Vertical. Oblique.
3. Relation { Parallel. At an angle { Right = perpendicular. Oblique { Acute. Obtuse.

D. — Points. *Represent corners; mark positions.*

This last work leads directly to measurement, where the exact distances between corners and points are determined by using a ruler.

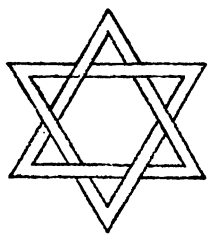
MEASUREMENT.

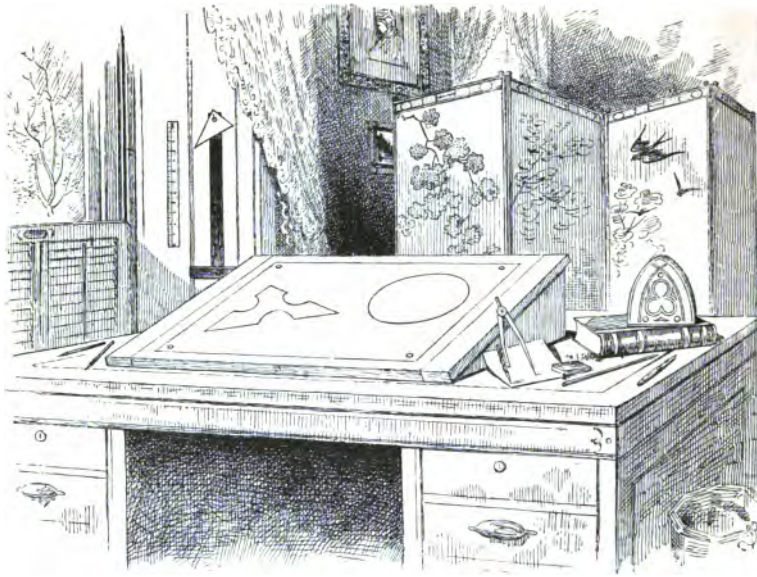
The Ruler should be of hard wood, with a straight sharp edge, one foot in length, and accurately divided into inches, halves, quarters, eighths, and sixteenths. Pencil marks should never be made upon the ruler, nor should its edge be cut or nicked.

Measuring. — Measure accurately. Do not depend upon the figures on the ruler: become familiar with the divisions, so that measurements may be read either way regardless of the figures. When determining short distances do *not* measure from the extreme end of the ruler, — begin at some prominent division. The divisions near the extreme ends are often inaccurate.

Pupils will need a large amount of practice to enable them to measure accurately and rapidly such simple objects as a sheet of paper, a book cover, the desk top, the slate, a pane of glass, etc.

After the first few exercises all measurement should be in connection with Geometry, Working Drawing, Development, and other divisions of the course.





GEOMETRY.

Geometry begins with the study of the type solids, — sphere, cylinder, cube, — their divisions, and variations, in the primary grades. These solids were studied for their rectilinear faces in the fourth year, and should now be reviewed for their curvilinear and mixtilinear faces.

MATERIALS.

The materials should be of good quality. Good results are seldom obtained with poor tools.

The materials should be distributed in good condition before the lesson, should be handled carefully by the pupils, and returned in as good condition as when distributed. At first, reliable pupils chosen by the teacher may have charge of the materials; but as the members of the class gain self-reliance, each should be held responsible for his own tools, like any other good workman.

Paper. — The paper should not be too rough. Smooth paper is best for first practice, for it does not so rapidly wear away the lead compass point. Thick, firm paper is preferable, for it is not easily punctured and torn by the steel compass point.

Pencil. — For geometric drawing the best pencil is rather hard, — a No. 3, or an H. It should have a smooth conical point for general work; but for Geometry, it should have a chisel point, made by sharpening a blunt conical point on two opposite sides only. This pencil should be reserved for geometric drawing.

Ruler and Ruling. — The ruler should have a straight, sharp, thin edge. The points between which a line is to be ruled should not be covered by the ruler, but a little allowance should be made for the thickness of the pencil point. The ruler should be placed so that the light may shine upon the edge against which the line is to be ruled. The pencil should be held nearly upright, and the line drawn from left to right.

Compasses. — The compasses should have a sharp needle point, and a rigid lead point sharpened on two sides only, — that next the needle point when the legs are near together, called the inner side, and that opposite this, called the outer side of the lead. The compasses should be held between the thumb and first finger, at the end above the hinge; and, in describing arcs, they may be turned either to the left or right as convenient. No hole should be visible at the center of a circle or arc; if one appears, smooth the paper from the back with the thumb-nail.

METHODS.

"Whatever knowledge is taught a child should be so taught that the act of acquiring it shall be of greater value than the knowledge itself."

— Dr. E. E. White.

Preparation. — All exercises of a lesson should be previously drawn by the teacher. They may be drawn upon charts or on the blackboard to assist in presenting or explaining the lesson. Such drawings are not to be copied by the pupils, but used as references only. From White's drawing models, set No. 2, select all those having faces of the shape to be studied, and those whose sections would give the required shapes. Compare these with the illustrations of geometric figures in Book V., page 7. Know every step to be taken, and be prepared to illustrate each by rapid sketches upon the blackboard.

Lessons. — Steps to be taken by pupils: —

Geometric Figures.

(*a*) Review the type solids, and select those having faces shaped like the geometric figures to be studied, and those whose sections would give the figures: compare these with the illustrations in Book V., page 7.
(*b*) Study the figures and develop definitions of each.
(*c*) Construct each mechanically.[1]
(*d*) Sketch the figures quickly upon the blackboard or on practice paper.
(*e*) Sketch their details, — altitude, diameter, diagonal, etc.
(*f*) Name several objects based on each figure.
(*g*) Practice, preparatory to drawing in the book.
(*h*) Draw in the book as directed. (See page 17.)

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[1] NOTE ON CONSTRUCTING CURVILINEAR FIGURES. — *The Circle.* A large circle may be drawn upon the blackboard or on a sheet of paper placed upon a table, as follows. Tie a loop, *L*, in the end of a fine strong string, and in it place the end of the crayon or pencil. Hold the pencil and loop between the thumb and finger of the right hand, as shown in Fig. 1, and the string in the left hand, so that it may be held tightly against the board under the end of the thumb at a point, *C*, at a distance from the pencil point equal to the radius of the required circle. Begin with the pencil point at *A*, and draw in the direction indicated by the arrow points, being careful to keep the string taut and firmly pressed against the center.

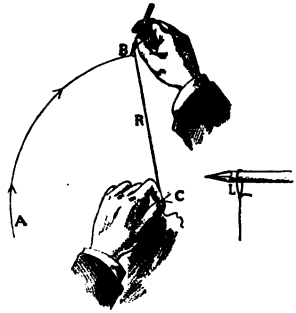


FIG. 1.

The Ellipse. — The easiest method for constructing a large ellipse is to drive two pins into the blackboard (if slate or plaster, of course the ellipse must be drawn elsewhere), or through the paper into the table top or board beneath. These pins should be about one foot apart and driven in firmly, perpendicular to the board. (See *F*1 and *F*2, Fig. 2.) Tie two loops in a fine strong string about fourteen inches apart. Place the loops over the pins, and with the pencil or crayon draw the string tight, as shown in Fig. 2. Begin at the point *A* and draw in the direction indicated by the arrow points, being careful to keep both parts of the string taut. Beginning again at *A*, draw the lower part of the ellipse. After such an exercise as this the pupil may be led to discover these facts: (1) That the combined distances from any point in the ellipse to the foci are always equal to the combined distances from any other point in the ellipse to the foci; that is, for example, that *P*, *F*1 + *P*, *F*2, is equal to

Ornamental Forms.

(*a*) Study the figures on page 7, in Book V. For what are such forms often used? (44 and 45, for door plates; 46, 48, and 47, in another position, as escutcheons around keyholes; all of them as ornamental panels. 48 and 45 suggest panes of stained glass windows; etc.)

(*b*) Study their construction. (40 and 43, squares and semicircles; 41 and 42, triangles and semicircles; 47, oblong and four semicircles; etc.) Show that outer and inner curves are struck from the same centers.

(*c*) Copy one accurately, enlarging it to about four times its present size.

B, *F*1 + *B*, *F*2. (2) That if the diameters *AD* and *BE* are given, the foci may be found by taking one half of the long diameter, *AG*, as a radius, and with one end of the short diameter, *B*, as a center, describing arcs to cut the long diameter at

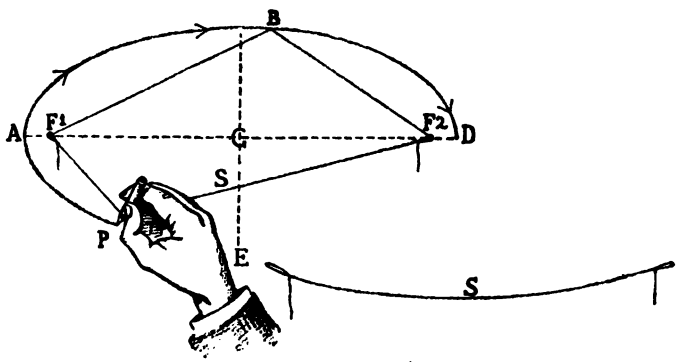


FIG. 2.

*F*1 and *F*2. (3) That when the foci are known, the length of string required to draw the ellipse is equal to the combined distances from one end of the short diameter to the foci, *E*, *F*1 + *E*, *F*2.

The drawing of a few ellipses mechanically will aid to establish an ideal ellipse in the pupil's mind, and he will not be so likely to draw pointed or blunt ellipses.

The Oval.—There is no simple method for constructing a true oval mechanically. An approximate oval may be made by combining a semicircle and half-ellipse, as indicated in Fig. 3. *ABCD* is the oval.

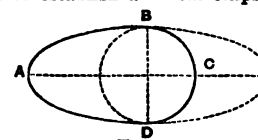


FIG. 3.

(*d*) Design an ornamental form by combining geometric figures so as to produce an harmonious result.

(*e*) Do the required work in the drawing book, according to instructions. (See page 18.)

The teacher should observe the following general precautions in all class work: —

"Make haste slowly."

Exact attention, and then give each direction distinctly.

Make sure that each direction is understood, but avoid repetition.

Allow no one to work during an explanation.

Give pupils sufficient time to perform each process correctly. By proceeding slowly, excellent and uniform class work may be procured and discouraging errors avoided.

Results. — A completed page of geometric drawing should have clean, dark margin lines, forming accurate corners; large, well-proportioned drawings placed symmetrically in the allotted spaces; and should show no finger marks or partially erased lines.

Whenever possible, the pupil should be required to invent processes of construction in making the figures, and to produce original results.

Objects based upon geometric figures are to be drawn free-hand, except when other objects are to be constructed from the drawings.

One result to be obtained is the *habit* of drawing objects according to a good method, namely: —

(*a*) Determine proportions, and indicate width and height with soft gray lines.

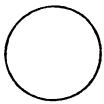
(*b*) Sketch, or block-in, the general contour or mass of the object.

(*c*) Determine proportions of subordinate parts, and sketch the parts.

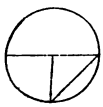
(*d*) Make corrections, if necessary, and erase all construction lines and errors; add only such details as especially help to identify the object, and finish with lines indicative of its character.

ILLUSTRATIONS.

Curvilinear Plane Figures (Drawing Book V., page 7).

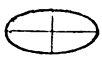


27. A circle.

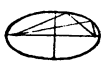


30. A circle with diameter, radius, and chord.

28. An ellipse.

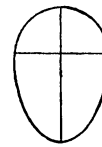


31. An ellipse with diameters.



31 *a*. Another ellipse, showing foci and chords.

29. An oval.



32. An oval with axes.

39. A lens, of which the "church oval" is a modified form.

38. A crescent or meniscus.

Applications (Drawing Book V., page 7).

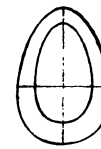
35. A circular fan.

33. A photograph frame, having an elliptical opening.

36. The bows or frames of glasses.

37. A protractor.

34. A horseshoe.

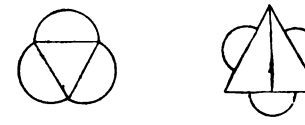


34 *b*. An oval pendant.

Ornamental Figures (Drawing Book V., page 7).

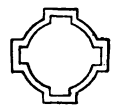
40 43

Forms of the quatrefoil.



41 42

Forms of the trefoil.

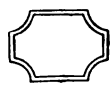


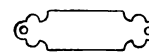
46

Elaborated form of the Greek cross.

48

Elaborated form of the diamond or rhombus.





45 44 47

44, 45, and 47, ornamental forms based on the oblong.

NOTE. — Object 33 may be constructed by the pupil from wood or cardboard covered with cloth; 34, from wood; 35, from cardboard and wood; 37, from cardboard; and 45, 46 and others will suggest forms of table mats and tiles which may be constructed from thin wood and engraved with the jack-knife, as exercises in manual training, to show the practical application of geometric figures in useful articles.

WORKING DRAWING.

Working drawings are made to guide workmen in accurately constructing such objects as tools and other utensils, machines, houses, ships, etc. They should give all needed information in regard to size, shape, and relation of the parts of the object to be made.

Views. — Solid objects have three dimensions — length, width, and thickness. All these cannot be seen their actual size from any one point of view; and as working drawings must give actual facts of form, more than one drawing of the object must be made. These drawings commonly represent two views of the object. For example, in Book V., page 8, Figure 11, two views of a cone are given. The circle represents a top view, such as would be seen by a person whose eye is directly above the apex of the cone; the triangle represents a side view.

Number of Views. — Some objects are so intricate that all their parts cannot be represented to advantage in two views. In such cases, three or more views are represented. But ordinarily a top view, a front view, and a side view suffice.

Position of Views. — The different views are grouped as convenient upon one sheet, or drawn upon different sheets. In either case, to avoid mistake, the different views are often lettered, "front view," "top view," "side view," "end view," etc., as the case may be.

In simple drawings like those required of pupils the front view is often drawn first, and the top view placed above it, or the bottom view below it; or the view of the left side at the left, or the view of the right side at the right, of the first drawing. Another method often used in machine drafting rooms is to place the views according to the principles of orthographic projection. This brings the top view below the front view, and the bottom view above it, — just the reverse of the first arrangement. Practically, it makes no difference how the views are placed, so long as there is no danger of confusion.

Conventional Lines. — Various kinds of lines are used with definite significance in working drawings: —

———————— *Full, clear, dark lines* are used to represent visible parts.

— — — — — — *Dashed lines* are used to represent invisible parts.

---- ---------- *Finely dotted lines* are used to connect different views.

— · — · — · — · *Dot-and-dash lines* indicate center lines or axes of objects. These are drawn only when necessary to locate accurately the centers of cylindrical, conical, or spheroidal objects.

<————4″————> *Very fine continuous lines, with arrow points and figures,* indicate dimensions.

NOTE. — In the early study of working drawing it will be found best to use only two kinds of lines; *full lines* for the finished outlines of the object, and *finely dotted lines* for connectives. Center and construction lines may be sketched very lightly, if necessary, and erased before finishing the drawing.

MATERIALS.

Paper should be of two kinds, — a cheap manilla paper for making preparatory sketches, and a paper of good quality with a granulated surface, like that in the drawing books.

Pencil, Ruler, Compasses, same as for Geometry.

METHODS.

Preparation. — Compare the drawings in Book V., page 8, with the objects which they represent, and understand the meaning of each line.

Carefully plan and draw all sheets or pages of working drawing before attempting to teach the class. This is of utmost importance. The views should be grouped symmetrically in the allotted space, not crowded nor detached; this means thoughtful planning before the lesson is given to the class. Make a freehand sketch from the object to be drawn, and mark the dimensions on the sketch. Make the finished drawing from the sketch.

Lessons. — Steps to be taken by the pupil: —

(*a*) Compare the type solids with their representations in Book V., page 8. Know what each line represents.

(*b*) Sketch quickly upon the blackboard, or on practice paper, two views of the solids selected for study.

(*c*) Name several objects similar to these type solids.

(*d*) Sketch upon the blackboard, or on practice paper, two views of some simple object based on one of these types.

(*e*) Make the required drawings in the book. (See page 19.)

NOTE. — The drawings should always be made from the object, and the different parts of the drawing should be spoken of as *views* of the object. The expressions *plan* and *elevation* may be used later.

For applications, select simple objects that illustrate the principle and may be drawn full size. Select for representation those views which are most characteristic of the object. (*a*) Make a freehand sketch of the object from each selected point

of view; (*b*) mark the dimensions; (*c*) plan the final drawing; (*d*) represent the principal parts first; (*e*) add all important detail; (*f*) correct, if necessary, and erase errors; (*g*) line-in with clear, sharp lines; (*h*) add delicate dimension lines and neat, unobtrusive figures.

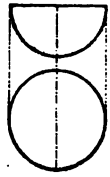
Results. — A clean, well-arranged page, accurately drawn and neatly lettered, is the ideal.

The lines representing the object should be of uniform strength throughout, and much heavier than all other lines used, so that they shall stand out in clear relief from them.

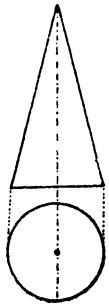
In more advanced, complicated drawings, the lines are sometimes varied in strength to indicate conventionally the relief of the parts.

ILLUSTRATIONS.

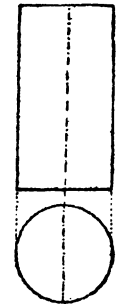
Type Solids (Drawing Book V., page 8).



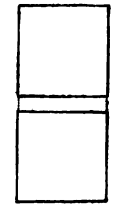
10. A hemisphere; side and top views.



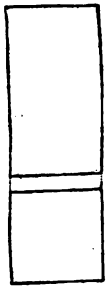
11. A cone; side and top views.



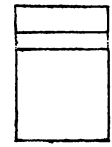
12. A cylinder; side and bottom views.



17. A cube; side and top views.

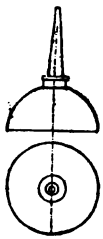


18. A square prism; side and bottom views.

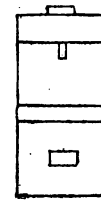


19. A square plinth; side and bottom views.

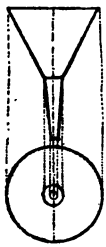
Applications (Drawing Book V., page 8).



13. An oil-feeder; front and top views.

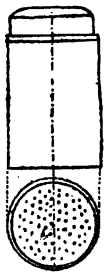


20. A box with cover, handle, and lock; front and top views.



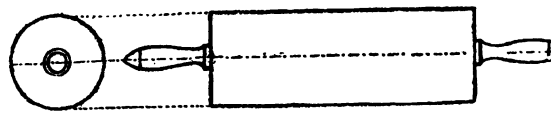
14. A tunnel; side and end views.

21. A varnish can; side and top views.

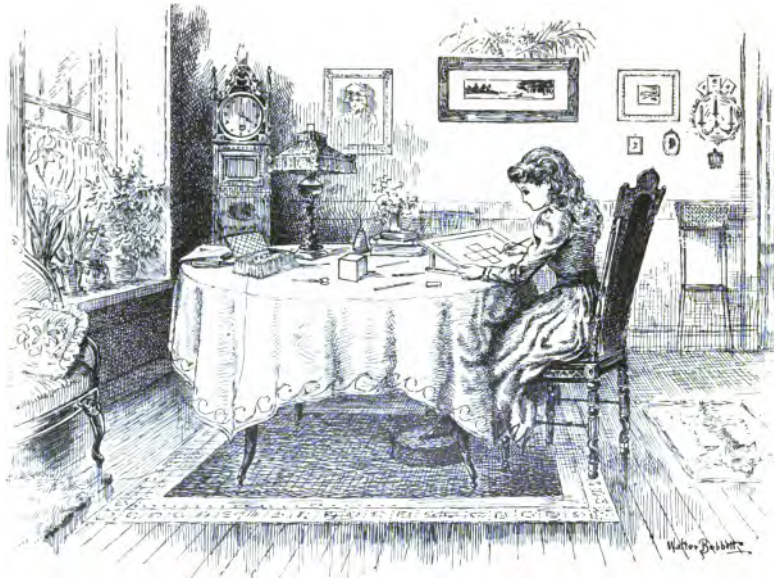


15. A salt shaker; side and end views.

22. A pasteboard jack-knife box; side and bottom views.



16. A rolling pin; end and side views.



DEVELOPMENT.

Developments, or patterns, are made for the construction of such objects as leather bags, shoes, boots, slippers, gloves, pocketbooks, cardcases, tin kitchen utensils, copper finials, ventilating ducts, and all other objects made of cloth, leather, paper, or sheet metal, which it is necessary to cut by pattern.

A development shows the entire surface of the object laid out in one plane, the different faces being of their actual shape and size, and so arranged that when folded the object may be exactly covered by the development, or its form reproduced.

MATERIALS.

Paper. — Use practice paper for the first freehand sketches, but the final drawing should be made on "oak tag," or paper of similar quality, — stiff, thick, tough, with a smooth surface.

Pencil, Ruler, Compasses, same as for Geometry.

Scissors, or a sharp-pointed knife, will be required to cut the developments.

Glue. — A liquid glue, or paste equally adhesive, should be used. Common, cheap mucilage is not satisfactory.

METHODS.

Preparation. — If the pupils have completed the work in Book IV., they will be able to understand the work of this grade, without the assistance of developments made from paper by the teacher previous to the lesson. The only preparation required will be to plan the sheet or page before giving the lesson, to be sure that the drawing will be well spaced; and to know "by heart" each step to be taken by the class. If the class has not had previous drill, the first lessons should be those outlined in the Fourth Year Manual, page 36.

Lessons. — Steps to be taken by the pupil: —

(*a*) *Select* from the models those only which have unequal plane faces at right angles. First take the square prism.

(*b*) *Draw the Development Freehand.* — Draw four horizontal lines only, and five vertical, as follows: Draw the first horizontal about four times as long as one side of the base of the prism; set off the proper lengths for each side, and mark the points of division 1, 2, and 3. Through 1 and 2 draw verticals as long as a side and one base above, and as long as one base below. Draw a second horizontal the proper distance above the first, and complete the drawing by adding lines representing the other edges, and by indicating the laps.[1]

(*c*) *Draw the Development Mechanically.* — Proceed as in freehand drawing; but measure and rule each line accurately and precisely.

(*d*) Cut out the development. Go over lines representing edges with a pin, or lightly with the point of a knife, to insure sharp edges when folded. *Fold with the lines on the outside.*

(*e*) Glue the prism into shape.

(*f*) Make the required drawing in the book. (See page 19.)

[1] Laps should never be added to those parts of a development which correspond to the bases or ends of prisms. Bases should always be bounded by a clean-cut, sharp edge.

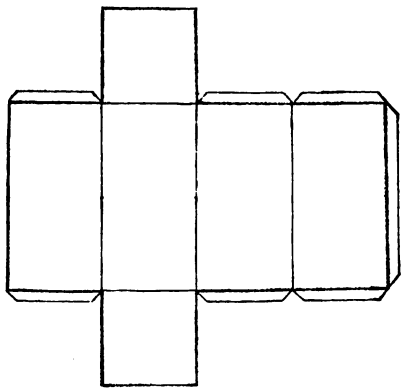
NOTE. — When drawing the developments of objects based on the type solid, step *a* is to be omitted, and such other changes and modifications as the character of the object may require can be made without changing the general order.

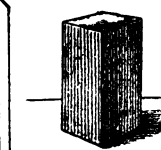
Results. — Drawings of developments must be accurate, otherwise the parts will not fold together perfectly. The lines representing edges should be sharp and dark and of uniform strength; those representing the laps should be lighter. Objects constructed from developments should be neat and accurate. These results can hardly be produced with poor material.

Encourage the pupils to make original applications or original modifications of selected objects, and original ornamentation of constructed objects.

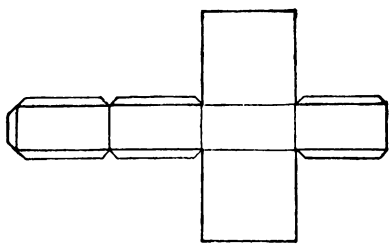
ILLUSTRATIONS.

Type Solids (Drawing Book V., page 8).



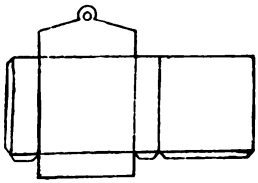


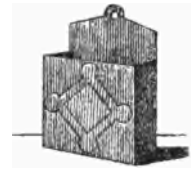
4. *A square prism.* — Four sides arranged horizontally; top face above and bottom face below the second side.



5. *A square plinth.* — Four sides arranged horizontally; top face above and bottom face below the third side.

Applications (Drawing Book V., page 8).



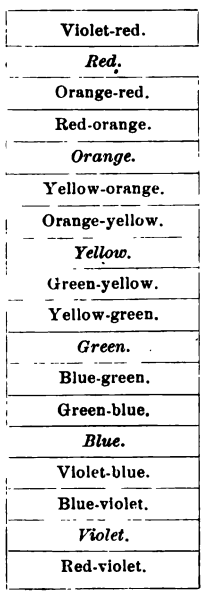


6. *A cardcase.* — Based on a square plinth. The ornamental top and front may be modified by the pupil.

2. DECORATIVE DRAWING.

Decorative Drawing, as a subject, includes the study of those elements which inspire, guide, and enrich ornamental designs. The designer finds inspiration and suggestion in *Plant Form*, ideal types and guiding laws in *Historic Ornament* and its derived principles of *Design*, and appropriate enrichment for his drawings in *Color*.

Decorative Drawing, as drawing, should be beautiful. Everything which aids in producing an ideal result is therefore legitimate — ruler, compasses, tracing paper, anything — in its proper place.

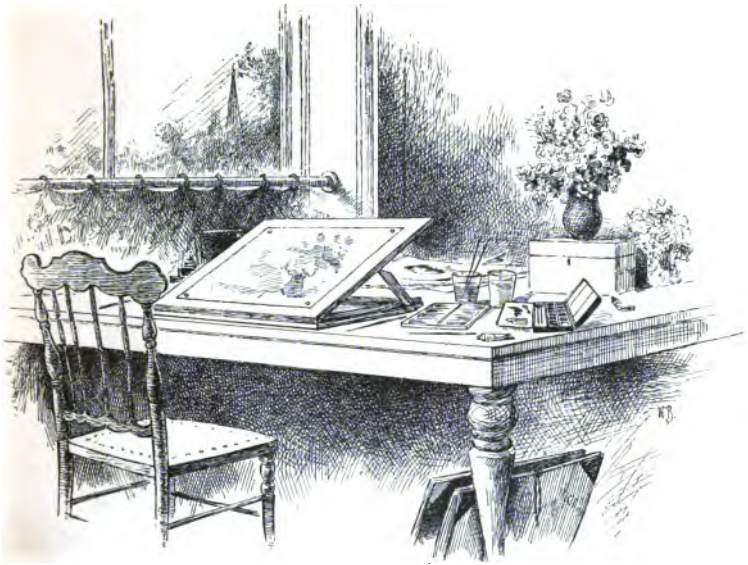


COLOR.

Color is taken first, that pupils may be prepared to observe and study it throughout the course in Decorative Drawing.

The work of this grade presupposes a knowledge of the spectrum and its different selected tones, and the ability on the part of the pupils to recognize, match, and name at least eighteen tones (namely, these arranged in a column), and to give them in order, beginning at the top.

Scales of Color. — Observation will reveal the fact that these colors do not appear the same under different conditions. *The value*



of a color changes as its illumination changes. For example: Under intense light, red will appear pink; under feeble light, a deep, rich brown. These variations of a color under different degrees of illumination are called its *tones.* These tones, when properly placed, produce a *scale of color.* Each standard and each hue is the central or *key tone* in a color scale, whose tones range from white to black. Five of these tones are to be seen in the selected scales used in this grade. All tones which contain white are *tints;* all which contain black are *shades.* For example: —

Red Tint No. 2.	Red Tint No. 1.	Standard *Red.*	Red Shade No. 1.	Red Shade No. 2.

Tints and shades may be illustrated by means of the color wheel and disks. By rotating a red and white disk together, tints may be produced; red and black disks will give shades.

Harmonies of Color. — When color tones are grouped so that they produce an effect pleasing to a cultivated color sense, they produce a harmony. Different groupings of tones produce different harmonies. One of the simplest groupings of tones produces a dominant harmony.

Dominant Harmony. — This harmony is produced by grouping *tones from one color scale.* For example, a tint, the key-tone, and a shade of violet would produce a dominant harmony in violet. Any tones in the scale may be combined, according to the taste of the designer: —

A tint, the key-tone, a shade.
Two tints and the key-tone.
Two shades and the key-tone.
Two tints and a shade.
Two shades and a tint.
A tint and a shade.
A tint and the key-tone.
A shade and the key-tone.

MATERIALS.

The materials for color work must be carefully protected from light, except when in actual use, and should be handled delicately, so that no finger marks or wrinkles disfigure the colored surfaces.

Tablets. — The teacher and each pupil should be supplied with the set of color tablets prepared by the authors of this course for use in the fifth year grade.

Papers. — Each teacher should be supplied with at least one package of the colored papers for the fifth year grade.

Other materials are such as have been used already in Geometric Drawing.

METHODS.

Preparation. — All exercises in color should be worked out by the teacher previous to the lesson. It would be well to use large

tablets, so that the completed exercises may form charts for class use.

Lessons. — A preliminary review may consist of: —

(1) The recognition, matching, and naming of each of the six standard spectrum colors: red, orange, yellow, green, blue, and violet; and the hues: violet-red, orange-red, red-orange, yellow-orange, orange-yellow, green-yellow, yellow-green, blue-green, green-blue, violet-blue, blue-violet, and red-violet.

A good order of steps in a lesson on recognizing, matching, and naming colors is as follows: —

After distributing materials,

(*a*) Study prismatic colors, thrown upon the wall or a screen by means of a glass prism.
(*b*) Select one standard color at a time.
(*c*) Select a tablet to match the chosen color.
(*d*) Give the name.
(*e*) Name objects having a similar color.
(*f*) Quote memory gems referring to the color.

(2) The arrangement of the standard spectrum colors and their hues, in the order seen in the spectrum.

(3) A review of the fourth year's work, namely, making scales of color with standard key-tones.

Other lessons are: —

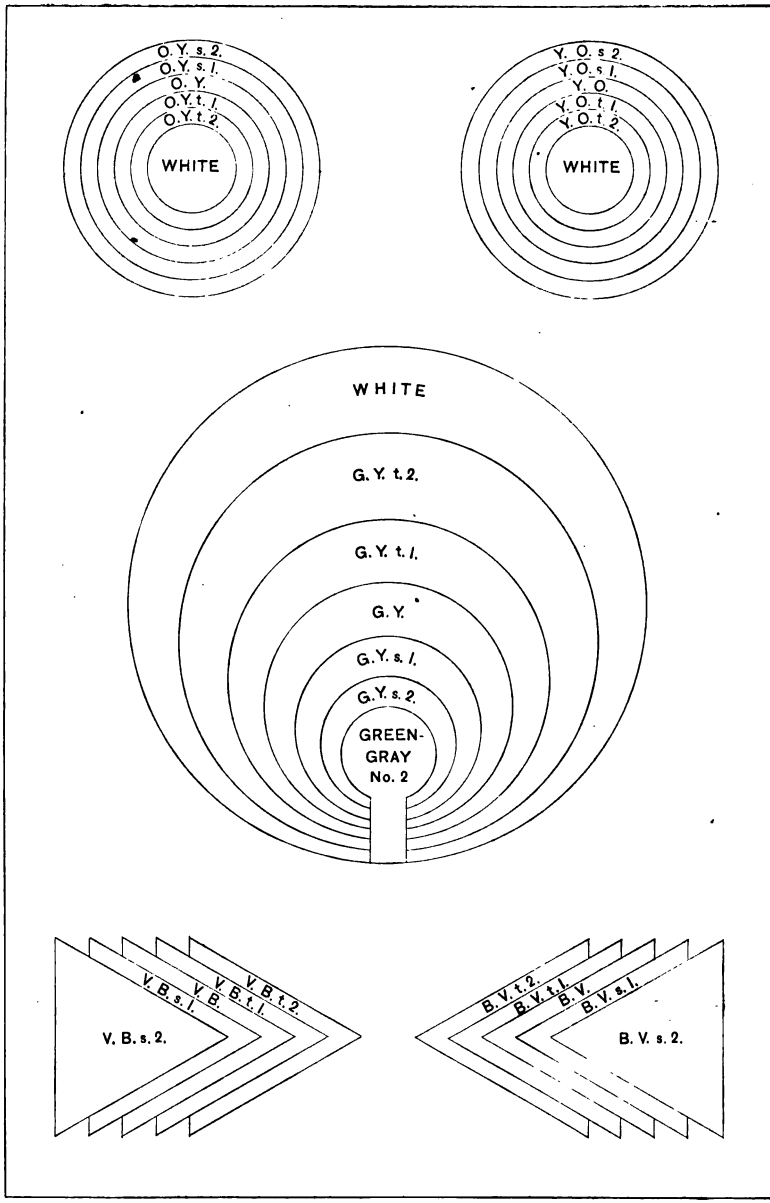
(1) Matching natural colors, — that is, selecting tablets to correspond with the colors of flowers, leaves, shells, etc.

(2) Arranging scales of color from dictation, from memory, with reference to fixing in mind the tints and shades of hues.

(3) Arranging triangles, squares, oblongs, and circles of colored paper to illustrate dominant harmony, with the endeavor to discover the most pleasing arrangement, or ratio of increase in area from the center outward.

Results. — Only final results are to be preserved in the book. Page 46 shows possible arrangements for a page of color.

COLOR CHART.


O. Y. s. 2.
O. Y. s. 1.
O. Y.
O. Y. t. 1.
O. Y. t. 2.
WHITE
Y. O. s 2.
Y. O. s 1.
Y. O.
Y. O. t 1.
Y. O. t 2.
WHITE
WHITE
G. Y. t. 2.
G. Y. t. 1.
G. Y.
G. Y. s. 1.
G. Y. s. 2.
GREEN-GRAY No. 2
V. B. t. 2.
V. B. t. 1.
V. B.
V. B. s. 1.
V. B. s. 2.
B. V. t. 2.
B. V. t. 1.
B. V.
B. V. s. 1.
B. V. s. 2.

BOTANICAL DRAWING.

Botanical Drawing includes the study and representation of plant form, as related to ornament and design.

MATERIALS.

Objects should be collected by the pupils under the supervision of the teacher. In this grade they include entire margined leaves.

Pencils for botanical drawing should be of medium softness, — a No. 2, or F, — and sharpened to a rather blunt conical point, that the delicate outlines of the selected forms may be appropriately represented.

Other materials required are like those already mentioned in other divisions.

METHODS.

Preparation. — The teacher should direct the pupils in the collection of leaves appropriate for the lessons. A lesson on the margins of leaves will guide them in selecting.

If necessary, the leaves may be kept for a day or two in water or in moist cotton, or best in a tight tin box placed in a cellar or some other cool place.

Lessons. — Before the leaves are drawn, they may be used for observation lessons, to give the pupils accurate knowledge of their characteristics. Steps to be taken by the pupil when drawing are: —

(*a*) Determine the position of the drawing in the allotted space.
(*b*) Sketch one bold free line to give the general swing or axis of the whole.
(*c*) Locate highest and lowest points, and indicate the greatest width of the leaf, in the proper position between its extremities.
(*d*) Sketch the outline.
(*e*) Sketch the principal veins.
(*f*) Correct, if necessary.
(*g*) Finish with lines expressing the character of the leaf.

Results. — The results should be truthful. Each line should have a meaning and character of its own. The drawing should represent the object as it appears, not conventionally. See illustrations in Book V., page 13, for "handling." The *ideal* drawing is perfect in form, delicate in handling, untouched by an eraser.

ILLUSTRATIONS.

Entire Margined Leaves (Drawing Book V., page 13).

25. Zinnia.
26. Plantain.
27. Pickerel weed.
28. Uvularia (bellwort).
29. Lily of the valley.
30. Sorrel.
30*a*. Smilax.
30*b*. Ripple grass.

31. Solomon's seal.

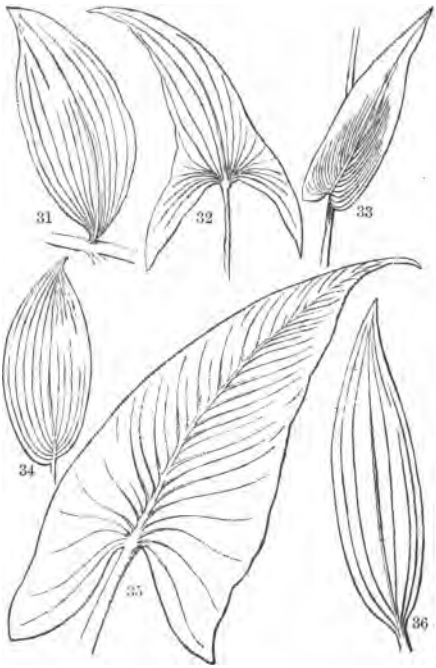
32. Sagittaria (arrowhead).

33. Spiderwort.

34. Smilacina.

35. Calla.

36. Japan lily.



HISTORIC ORNAMENT.

Historic Ornament includes the study and representation of those examples of decorative design which have been preserved from the works of ancient and mediæval artists. A group of artists whose work is similar in its inception or expression forms a *school.* This term is also applied to the results of the coöperation of a school. The different schools may be distinguished by certain characteristics; and all Ornament usually studied by modern designers is divided, according to these distinguishing marks, into six groups, schools, or styles, namely: —

Three Ancient Schools, — Egyptian, Greek, Roman.

Three Mediæval Schools, — Byzantine, Saracenic, Gothic.

The subject begins in this grade with simple units, chosen from different schools to illustrate modifications of the square.

MATERIALS.

The ornaments for study are found in Drawing Book V., page 14, and they may be supplemented by drawings from books on ornament and photographs of historic architecture. In the public library such works may be found and consulted.

Pencil, paper, scissors, etc., as previously described.

METHODS.

Preparation. — The teacher, to do the best work, should be familiar with the outline of the history of Ornament (Wornum's "Analysis of Ornament" is a standard work), and with the interesting details of the history of common units like the lotus, the wave scroll, the fret, the lily, the acanthus, the various crosses and symbols used in the different schools. Such information cannot be gathered from any one book, but from general reading on historical subjects connected with art. But for giving the lessons here outlined, a careful study of the notes on the illustrations will enable the teacher to obtain good results.

Lessons. — Steps to be taken by the pupil: —

(*a*) Study the illustrations in Drawing Book V., page 14. Answer such questions as the following: —

What is common to all?
Which embody most force? Why?
Which are most graceful? Why?
Which are most beautiful? Why?
What is the general tendency in the growth of each?
What details of plants do they resemble? Of what plants?
Which appears most difficult to draw? Why?

(*b*) Sketch one or more examples upon blackboard or practice paper in the following order: (1) sketch axis; (2) fix length and width; (3) sketch other lines which determine prominent parts of the figure; (4) sketch general outline; (5) sketch details; (6) correct; (7) line in.

(*c*) Select one or more, and draw in the book as required.

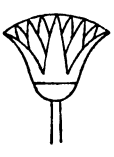
(*d*) Practice cutting the units from paper, by folding and cutting as much as possible at once. (See notes on page 65.)

Results. — The pupil should soon acquire an appreciation for simple, well-constructed forms of chaste outline.

The drawings should be as large as the allotted space will allow, accurately proportioned, with good curves, and soft, gray lines, — ideals of decorative form.

ILLUSTRATIONS.

Bilateral Units (Drawing Book V., page 14).



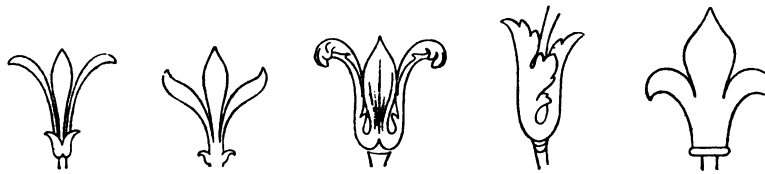
13

14

13. ***The Egyptian Lotus.*** — A conventional form constantly recurring in the enrichment of walls of temples and on mummy cases.

14. ***The Egyptian Papyrus.*** — A conventional form of the head or frond of the plant, constantly used in architecture.

15 and 16. *Greek Conventional Units.* These are supposed by some to have been derived from the honeysuckle, by others from the lily, and by still others to be mere brush marks grouped according to the laws of natural growth. However, these forms, usually called the Greek lilies, have been venerated for centuries as types of unsurpassed beauty.



15 16 17 18 19

17 and 18. *Roman Acanthus Husks.* — Conventional forms of the bracts which sheathe the stem of the acanthus plant at its nodes or joints. This plant was used by the Romans in almost all their architectural enrichment, and from it they developed the most luxurious ornamental foliage the world has ever seen.

19. *Gothic Unit.* — Probably suggested by the fleur-de-lis, or iris: constantly recurring in ornament of this school.

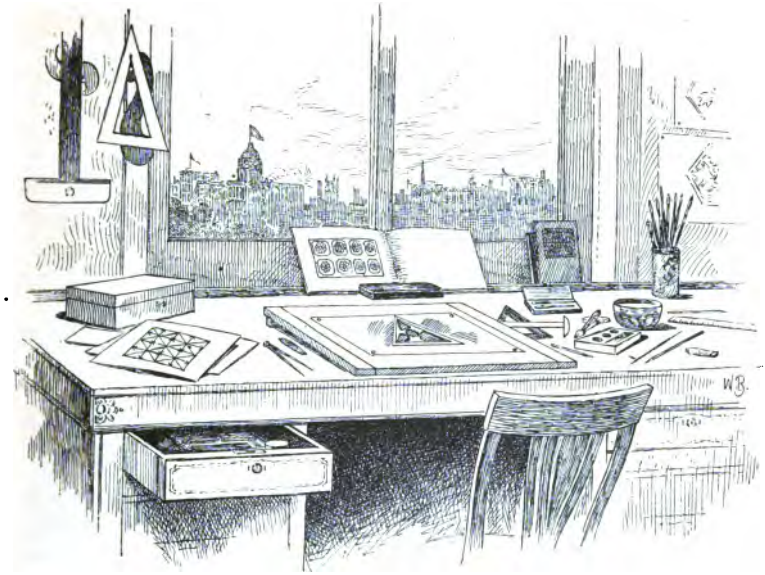
20. *Byzantine Unit.* — An illustration of the excessive pointing of leaf lobes practiced by artists of this school.

20 21 22 23 24

21 and 22. *Saracenic Units.* — If derived from plant form, they are so highly conventionalized that their identity is lost. They are from the Alhambra at Granada, and show the fondness of the Moors for reversed curves.

23 and 24. *Gothic Unit.* — From ornament of Cologne cathedral, typical of a large class of Gothic ornamental details which are three or five-lobed.

NOTE. — These figures are given as suggestions for the modification of bilateral units; only one or two of them can be cut from paper in one piece. The general shape and arrangement of lobes may be imitated, and very beautiful units produced for use in design.



DESIGN.

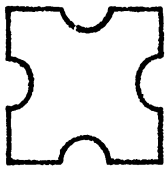
Design, as a subject, includes the study of designs (whether historic or modern) to determine their structure, their laws and principles, and their form; the modification of geometric figures and the conventionalization of plant forms for units of design; and the creation and expression of arrangements of ornamental forms according to recognized rules.

Laws. — There are three great laws of arrangement; namely, *repetition*, *alternation*, and *symmetry*. These are already familiar to pupils who have taken the primary course in drawing. In addition, there is one great law governing all arrangements making use of plant forms; namely, *growth* — the natural dependence of parts. These laws are fundamental and unchangeable.

Principles. — There are also certain other rules to be observed, called *principles of design*. These have been evolved through comparison of ornamental designs of different schools and times, and serve to guide the designer in his work. The fol-

lowing three principles of design were studied by the pupils in the fourth year, and should be reviewed this year: —

1. CONTRAST, — the proper opposition of parts. *Contrast of line* is produced when curved and straight lines are opposed to one another or succeed each other agreeably, as in Figures 1 and 2.



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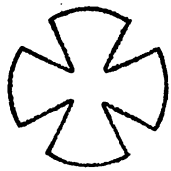

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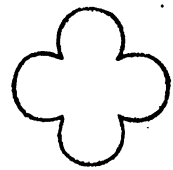

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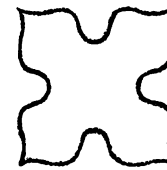
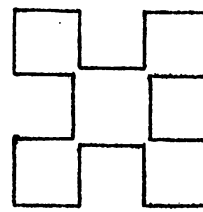


4

Contrast of form is produced when masses of one kind are opposed to or succeed those of another, as in Figures 3 and 4. In Figure 3, the rounded lobe contrasts with the acute sinus; in Figure 4, the pointed lobe with the rounded sinus.



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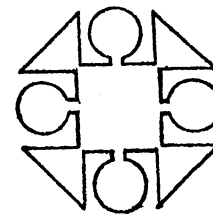
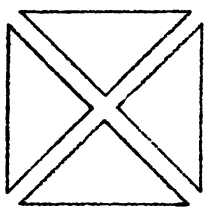


6

2. UNITY, — the proper subordination of parts. Figures 1, 2, 3, and 4 illustrate this principle: the lobes are subordinated to the mass; that is, each figure appears to be a *unit*. But Figures 5 and 6 appear to be aggregations of units instead of single units modified.



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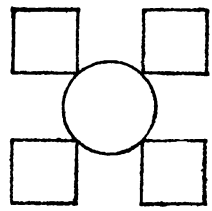
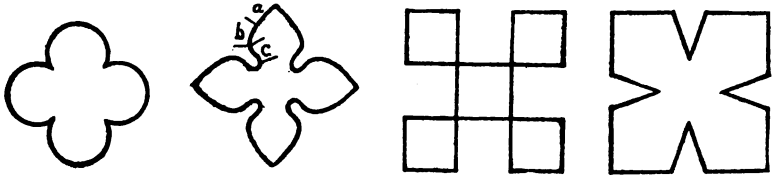


8

3. STRENGTH, — the proper union of parts. Figures 1, 2, 3, and 4 illustrate strength, the lobes being well held together; Figures 5 and 6 show weakness, for the parts seem to have very inadequate support. Perhaps the most flagrant violations of this principle are to be found in such designs as Figures 7 and 8, where the parts are not united at all, or merely by points.

And three other principles should be taught, namely: —

4. *Variety,* — the proper difference of parts. Contrast may exist between two kinds of things; variety, between two things of the same kind. A group containing circles, squares, and triangles shows contrast; a group of scalene, equilateral, and obtuse-angled triangles



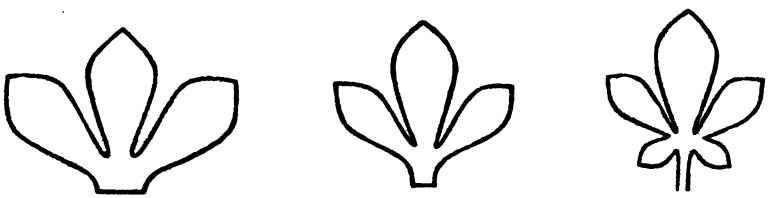
9 10 11 12

shows variety. Figure 9 shows contrast, but no variety, — any section from any curve would be just like any other; but in 10 is variety, the section of the curve *a* is different from *b*, and both different from *c*. In 11 there is no variety, all the lines being equal. Figure 12 shows variety, — all straight lines, but of different lengths.

5. *Rhythm,* — the proper recurrence of parts; repetition *with accent.*

13 14

Figure 13 is mere repetition; 14 has rhythm. In a bilateral unit, 15 corresponds to 13, while 16 has rhythm, and 17 has it more



15 16 17

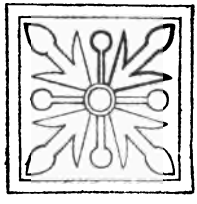
perfectly. Rhythm may then be produced by the recurrence of similar parts of different sizes.

6. *Repose,* — the proper correlation or grouping of parts. In 18 and 20, each unit by itself is not bad, but when grouped they appear stiff, and each seems to care more for itself than for the design as a whole; each is selfish, having no interest in the good of all. But in 19 and 21, each helps all, and all each, to make a pleasing whole.

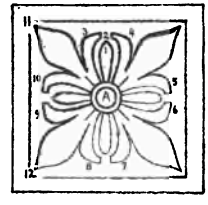
18

19

The parts work together in groups. In 19, the curve 1–2–3 is repeated by the curve suggested by the ends of the petals, again by the curves 4–5–6, and 4–7–8–9, each harmoniously relating smaller groups of parts; and these largest curves, overlapping, join all into one unity. In 21, a loop is thrown out from A through 1, another from A through 2, and still another is suggested from A through 3



20



21

and 4. All the lobes, 3, 4, 5, 6, etc., fall into a circle similar to A, and those on one side, 11, 10, 9, 12, suggest a double reversed curve swinging from one corner of the square to another, each lobe furnishing its part. One is never sure of the value of a unit until it is seen in its relation to others.

NOTE. — These principles may be forcibly illustrated by folding and cutting paper units similar to those illustrated in Figures 1 to 21.

MATERIALS.

The materials are such as have already been described under Historic Ornament, and in addition the illustrations in Book

V., pages 19 and 20. A few designs constructed from colored paper will be found helpful in stimulating the interest of the children.

METHODS.

Preparation. — The teacher should either enlarge a historic unit or make an original one, and, using it as a pattern, cut out colored paper units and construct a border (see Drawing Book V., page 20, Figures 58, 59, and 60) and a surface (Figures 61 and 62). These designs will suggest ideas to the pupils, and will serve as charts to illustrate what is required of them.

Lessons. — When reviewing the modification of geometric figures, each pupil should, if possible, have a pair of scissors and a sheet of thin paper, so that each may discover for himself the effects of modifying corners and sides. The principles of contrast, unity, and strength (taken up in the fourth year) should be reviewed, and variety, rhythm, and repose should be taught.

In producing original designs the following exercises are to be performed by the pupil: —

1. *Comparative Study.*
   (*a*) The basal figures, 34, 35, 36, 37. Which are best adapted for use in borders? In surfaces? In centers? Why?
   (*b*) The bilateral units, 38 to 57. Which illustrate the principles most completely? Which are best adapted for use in borders? In surfaces? In centers? Why? Do any of the units violate a principle? Which are most beautiful in themselves? Which would be most beautiful in a design? Etc., etc.

2. *Cutting Selected Units.*
   (*a*) Have a 4″ square.
   (*b*) Fold it on a diagonal.
   (*c*) Cut the shape of the basal form of the unit.

(*d*) Draw one half of the selected unit.

(*e*) Cut both halves at once. By folding two or more squares together, more than one unit may be cut at a time.

3. *Cutting Original Units.*

Steps are similar to those just outlined. It is almost impossible to make a modification that is not original. The first results may be crude, but if they are produced by the pupil's own thinking, — not copied, — they may be commended.

4. *Drawing Original Units.*

Prepare the page in the drawing book as directed, and draw the unit of the proper size. (See page 21.)

5. *Copying a Design.*

(*a*) Determine how many times the figure is to be enlarged[1] to properly fill the allotted space.

(*b*) Draw accurately the oblong containing the design, the proper size for the space.

(*c*) Subdivide it, by lines which help in drawing the units, into as many parts as there are units in the figure. (For example, in Book V., page 20, Figure 63, the lines would be oblique, dividing the figure into squares *on their diagonals*, and half squares.)

(*d*) Draw one unit with the utmost precision; transfer it, — that is, reproduce it in the other squares either by measure-

---

[1] *Note on Enlargement.* The unit to be enlarged is, in each case, based on a geometric figure. (*a*) Draw the geometric figure upon which the unit is based of such a size as to look well in the space: (*b*) draw the diameters or diagonals, or other lines which aid in establishing definite points in the figure: (*c*) enlarge each part proportionally — that is, if a curve in the figure extends to the middle of a semi-diameter, it should extend to the middle of a semi-diameter in the drawing; if a cut occupies one third of a side in the figure, it should occupy one third of a side in the drawing.

The pupil should be trained to enlarge by the eye, without measuring proportions; therefore, measurement of proportions should *always follow* the freehand sketching of the parts, never precede it.

The drawing of decorative units at this early stage may be freehand, if the pupil needs special training in freehand drawing; when, however, the units are to be used in designs, — repeated many times, perhaps, — mechanical aids should be employed to insure accuracy.

ment, by tracing around a paper unit, or by the use of tracing paper.[1]

(*e*) Erase all construction lines, and make necessary corrections.

(*f*) Line-in the design and add half-tinting if required.[2]

6. *Drawing the Original Design.*

Steps are similar to those just outlined. The original unit may, perhaps, now be slightly modified, to advantage, for the *spaces* between the units may be made as important a decorative feature as the unit itself.

7. *Constructing from Colored Paper.*

(*a*) Select two or three tones from one scale. (See notes on Harmonies of Color, page 44.) If the design is for a surface, two tones will be enough, — one for the ground and one for the unit. If for a border, three may be used, — one for ground, one for units and margin, one to outline or separate the margin from the ground.

(*b*) Make the ground for the design of the proper size, and on its white side draw lightly the construction lines for the design; these will aid in determining the size of the units. Then number, and space over the ground.

(*c*) Cut one unit from "oak tag" as a pattern, and trace and cut the others from this.

(*d*) Cut the margin lines if any are required.

(*e*) Fasten the units in their proper positions, using little glue. Never cover the entire under-surface of a unit with

---

[1] *Note on Tracing.* After half of a unit is drawn, lay a piece of tough tissue paper, or better, genuine tracing paper or tracing cloth, over the unit, and trace the outline with a well-pointed and rather soft pencil. Place dots on the tracing paper indicating extreme points of the axis of the unit, to assist in correctly placing the tracing upon the other side. Fit the tracing, *drawn side down*, upon the other side, and go over the outline again. Repeat for other units, reversing the tracing paper each time. Entire units may be traced and transferred in a similar manner.

When a tracing cannot be reversed, blacken the under side of the tracing paper by going over it with a soft lead pencil, and place it, blackened side down, in the proper position. Go over the lines of the drawing with a hard pencil. This will leave an impression of the drawing on the page.

[2] *Half-tinting* is a uniform tone produced by soft, fine, parallel lines added to a design to make its parts clearer by contrast. A design drawn in outline merely does not always pronounce itself sufficiently, and it is sometimes difficult to distinguish the units from the spaces. Half-tinting will reveal the true units, and give repose to the design.

glue; the design will not dry flat. Add the margins if required. (See notes on Paper Cutting, pages 63–68.)

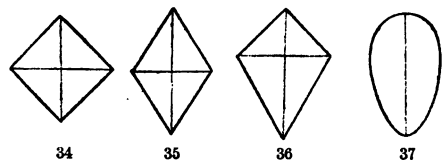
Results. — The original units may be considered good at this stage, if they do not violate a principle of design and are well drawn and cut.

The drawings should be clean and clear. The soft, broad, gray line is out of place in surface decoration; it is too indefinite, and occupies too much space. A delicate, gray line is preferable.

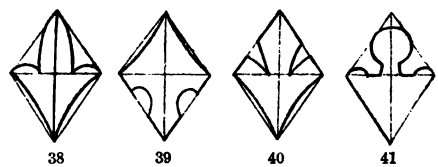
The constructed designs should be correct in spacing, accurate in cutting, and neatly glued. The *end* to be secured is *beauty*. Every means should be used to obtain an ideal result.

ILLUSTRATIONS.

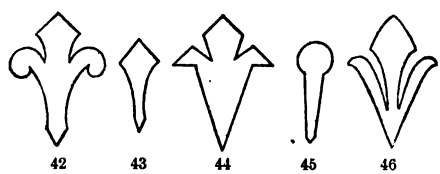
Modified Bilateral Units (Drawing Book V., page 19).

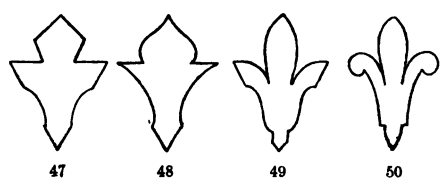


34 to 37. *Figures usually underlying Bilateral Units.* 34. The square. 35. The rhombus. 36. The kite-shape. 37. The oval.



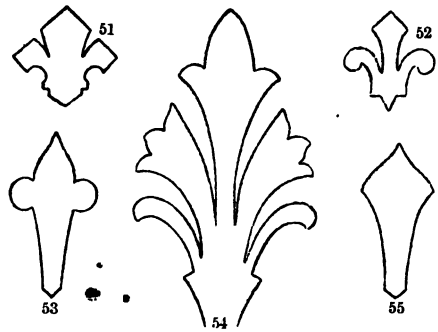
38 to 41. Units based on the rhombus or diamond.





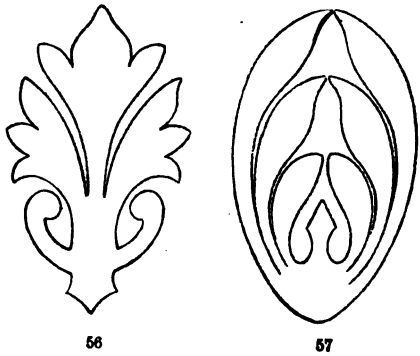
42 to 50. Units based on the kite-shape or trapezium.

51, 52. Units based on the square.

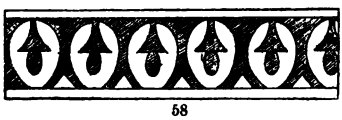


53, 54, 55. Units based on the kite-shape.

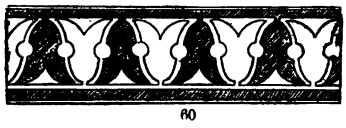
56, 57. Units based on the oval.



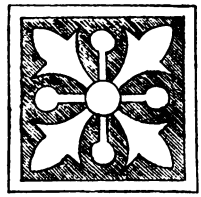
Borders, Surfaces, and Centers, with Bilateral Units (Drawing Book V., page 20).



58. Alternation, — oval and triangular units.
59. Alternation, — triangular units.

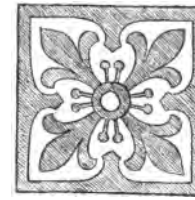


60. Alternation of position and color, — counterchange, — triangular units.
64. Alternation, — two modifications of kite-shape.



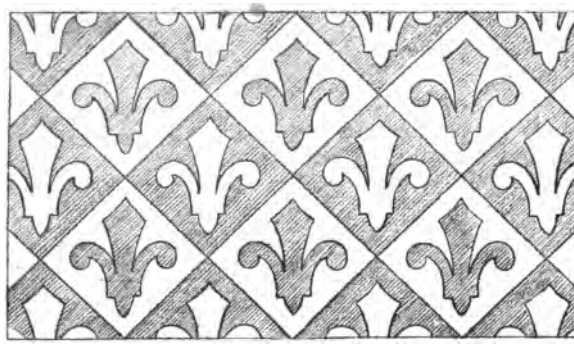
61

61. Alternation, — plain margin.



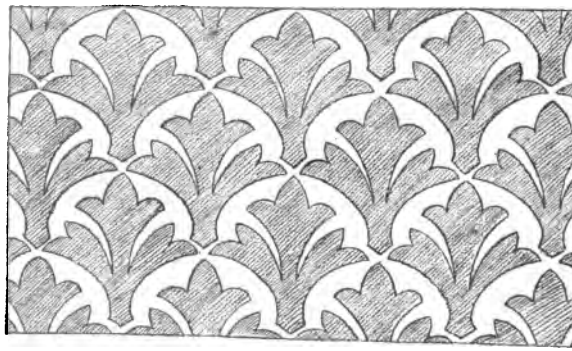
62

62. Alternation, — ornamental margin.



63

63. Surface, — repetition of units, and alternation of color. Construction lines of ground made a feature in the design.



65

65. Surface, — repetition. Units modified squares, suggesting leaf forms. Construction lines suppressed.

PAPER CUTTING.

Paper Cutting includes the making of units of design or other ornamental details for use in constructing designs of colored paper. It is an elementary form of Applied Design, and may illustrate the essential principles of good design for surface decorations, such as ceiling patterns, wall papers, and carpets.

These essential principles are: —

1. *Flatness.* — Surfaces which are to be used as backgrounds for pictures, furniture, etc., should not be so ornamented that their apparent flatness is destroyed. Perspective effect or the appearance of high relief are entirely out of place.
2. *Equable Distribution of Masses.* — Irregular or large uncovered portions of surface should not occur in the same pattern with closely placed units, unless the intention is to produce a stripe. But pronounced stripes are out of place in floor coverings, and, as a rule, in wall or ceiling papers. Stripes tend to lead the eye rapidly over the surface, and off it; the pattern should simply enrich the background without giving it prominence or making it obtrusive.

3. *Harmonious Coloring.* — The specially prepared colored papers furnish the very best means for the employment of harmonious coloring in elementary designs.

MATERIALS.

Paper. — For cutting patterns to be used in tracing other units, "oak tag" (used in Development) is best. For folding and cutting a number of thicknesses at once, the thin, soft, colored papers are best. Thick or stiff papers do not fold closely.

For constructing designs the Bradley colored papers (selected by the authors, and known as WHITE'S) are best.

Scissors. — Sharp, steel scissors are best for this work. Cheap iron scissors tear the paper instead of cutting it, and soon get out of order.

Other materials are like those already used.

METHODS.

NOTE. — Nearly all paper cutting should be taken in connection with other work, — Historic Ornament and Design. (See notes on these subjects.)

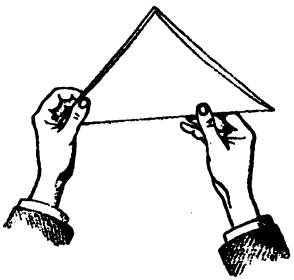
Preparation. — The teacher should work out the exercise previous to the class lesson, to discover any points of difficulty.

Lessons. — Steps to be taken by the pupil: —

1. *Making a Pattern.*
   (*a*) Draw the geometric figure upon which the unit is based with the utmost accuracy, using fine sharp lines.
   (*b*) Sketch very lightly the mass of the *whole* unit, to insure correct general proportions.
   (*c*) Draw one half as perfectly as possible.
   (*d*) Fold and cut out the unit, following the drawn lines. Make smooth regular cuts, that the pencil-point may pass smoothly around them when tracing.

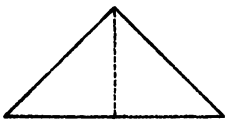
2. *Cutting Several Units at once.*

(*a*) Select a square of the right size and color.

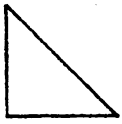


(*b*) Fold it upon a diagonal.

(*c*) Fold it upon the other diagonal, indicated by the dotted line in *c*; the paper will then have the shape c^2.

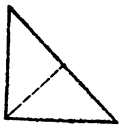


c



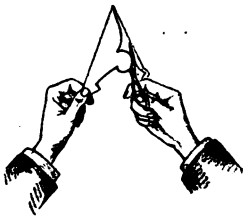
c^2

(*d*) Fold it to make the diameters of the square, indicated by the dotted line in *d*. The small folded triangle will now be equal in area to just one eighth of the original square.

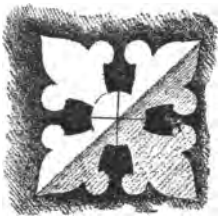


d

e



f



k

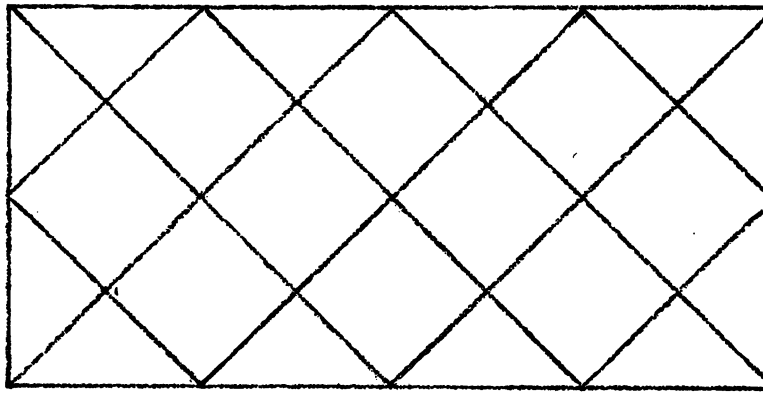
(*e*) Hold the paper triangle by the point which corresponds with the center of the square (see *e*), and draw upon the triangle *that portion of the outline of one unit which is covered by the paper.*

(*f*) Hold the paper firmly to prevent slipping, and cut on the drawn line (see *f*). The paper will then have the shape *g*. Unfolding, the shapes *h*, *i*, and *k* will be revealed. (Figure 23, in Historic Units.)

g

h

i



a

3. *Constructing a Surface Design.*

The selected example is Figure 65, on page 20 of Book V.

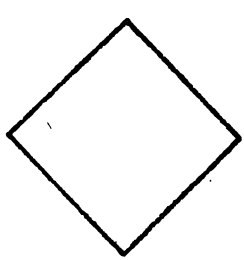
This design may be constructed by dividing the surface into squares by means of oblique lines, as in *a*, and cutting units to fit into these squares, as follows:

(*a*) Select a sheet of the proper color and size for a background. Draw lines accurately upon the back or white side, which shall by their intersections locate the *corners of units.*

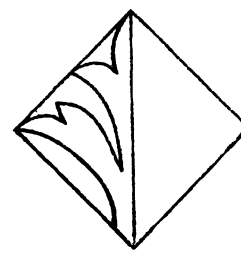
(*b*) On a sheet of "oak tag" draw accurately, and of exact size, *one* of these squares. (One is shown enlarged, for convenience, at *b*.)

(*c*) This square now circumscribes one unit, and its vertical diagonal forms the axis of the unit.

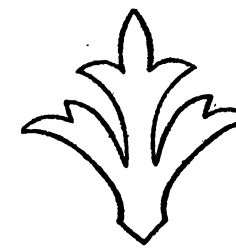
(*d*) Draw accurately one half the unit, *c*.



b



c



d

(*e*) Draw the other half, by transferring the lines of the first. (See note on tracing, page 59.)

(*f*) Cut out the pattern, and by it cut a sufficient number of units from paper of the proper color.

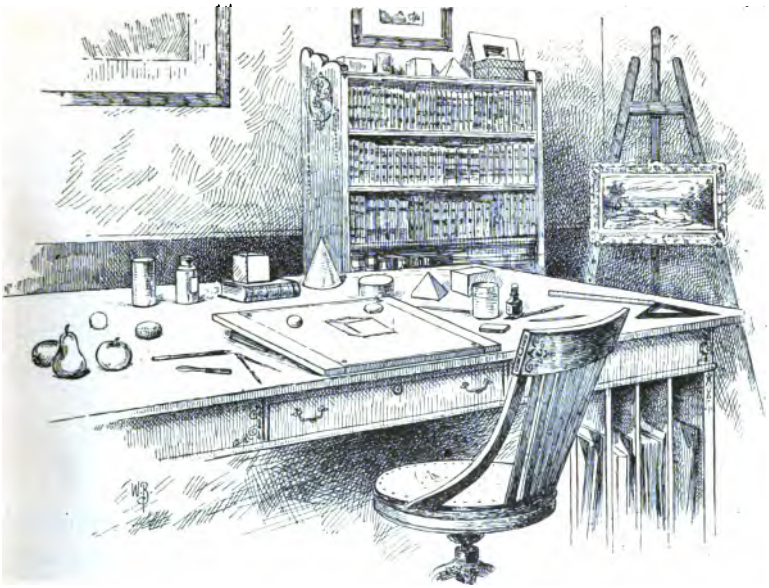
(*g*) Apply these units to the ground, each in its own square. Add half units where necessary.

The pattern on page 68 shows a design constructed from three tones of colored paper.

Results. — The pupils should be taught to lay out their designs so that they will *repeat.* That is, opposite sides or opposite ends should correspond; if units are divided in the middle at one side, they should be so divided at the opposite side of the design.

The constructed design should be harmonious in color, accurately cut and spaced, and neatly constructed.

Design Constructed of Colored Papers.



3. PICTORIAL DRAWING.

MODEL AND OBJECT DRAWING.

Pictorial Drawing includes the study and representation of objects as they appear to the eye from one point of view.

Type Solids. — The principles which govern the correct pictorial representations of objects may best be learned through the study of type solids, which lack perplexing details.

Applications. — When the principles are learned, they should be applied in the pictorial representation of

(*a*) Objects similar to the type in form.
(*b*) Groups of objects based on types.
(*c*) Sketches from nature, — landscape, etc.

MATERIALS.

Models. — Each pupil should be supplied with White's Drawing Models for advanced classes. During this year he will need the hemisphere, cone, and cylinder.

Objects. — Each pupil should be supplied with objects based on the type forms. For the first lessons, the objects should be alike if possible, — that is, each pupil should have an apple. But later, each pupil may select his own application, — one an orange, one an apple, one a pear, etc.

Paper. — Manilla practice paper, 9″ x 12″, is best for first work.

Pencil. — The pencil should be of medium softness, — an F, or M, or No. 2, and sharpened to a rather blunt, conical point.

Wire. — A piece of wire or a knitting-needle will be found very helpful in determining levels.

METHODS.

Preparation. — The teacher should work out each exercise before giving it as a class lesson, to insure easy and logical steps for the pupils.

Lessons: I. *Type Solids.*

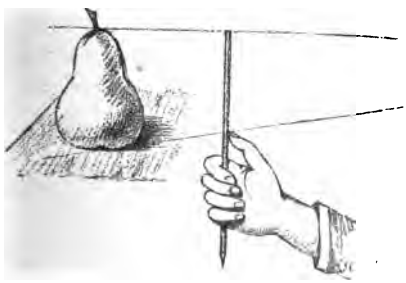
NOTE. — Model drawing, or drawing from type solids as they appear from one point of view, is the basis of all pictorial representation. Continued practice, intelligently guided by principles, will insure correct, accurate drawing.

A certain amount of preparatory drill may be required before drawing directly from models.

1. *Preparatory Drill (review of fourth year's work): Effects of Distance.* — Lead the pupil to see that objects seen at a great distance appear smaller than similar objects when near, — houses, trees, etc., for example. What is true for great distances must be true proportionally for short distances. One effect of distance, then, is to *decrease* the apparent size of an object. Hold the pencil — or, better, a wire — horizontally in front, and at arm's length. Closing one eye, move the wire until it appears to coincide with the back edge of the desk. Hold it to appear to coincide with the back edge of the next desk in front. Must the wire be raised or lowered? The two desk-edges are practically at the same level, but one is farther away. Another effect of distance, then, is *to change the apparent level* of objects. Give many illustrations of this.

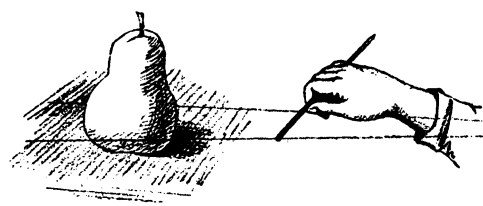
2. *Preparatory Drill (review of fourth year's work): Proportional Measurement.* — Sit erect; hold the pencil vertically at arm's length in the position indicated in *A*. Close one eye; with the other, sight over the top of the pencil to what appears to be the highest point on the object; and over the thumb-nail, held against the pencil (see *B*) sight the lowest point visible on the object. A certain distance on the pencil will now appear to cover the entire apparent height of the object. Now turning the pencil horizontally, the entire width may be measured in a similar way (see *C*). By comparing the two measurements on the pencil, their relative lengths may be determined.

A



B

N.B. — Such measurements should always be taken at arm's length in this grade. *They do not give size:* they give *proportion only.* They should be used principally *to test* sketches. As a rule, the first lines of the sketch should be drawn as they appear to the unaided eye, that the judgment of proportion may be trained. Later, proportional measurement will be rarely used.



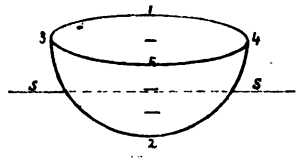
C

3. *Drawing from the Solids.*

The Hemisphere: Foreshortening. — Steps to be taken by the pupil.

(*a*) Place a 2″ hemisphere in the groove at the back of the desk, and in the center from side to side, — directly in front of the observer.

(*b*) Hold the wire horizontally, so that it appears to touch the highest point visible (1); the lowest point visible (2). Hold the wire vertically so that it appears to touch the point farthest to the left (3); farthest to the right (4).



(*c*) Decide upon the size of the drawing and indicate these four points on the paper. The whole width and height of the object is now fixed.

(*d*) Locate the nearest point (5). The apparent height of the top (1–5), is, in this case, $\frac{2}{5}$ of the whole height. This proportion should be tested by means of the pencil. This face is *foreshortened.*

(*e*) Sketch the ellipse — 1–3–5–4.

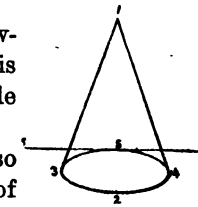
(*f*) Sketch the semicircle — 3–2–4.

(*g*) Hold the wire so that it appears to cover the back edge of the desk (*s*–*s*). Determine its apparent level, — in this case about one third down between 5 and 2. Sketch this line.

(*h*) Erase mistakes.

(*i*) Line-in with a soft gray line, making the lines of the object a little darker than the shelf-line.

The Cone. — No new principle is involved in drawing the cone. One new condition is presented, — the drawing of invisible parts.



(*a*) Place a 2″ cone on a 4″ square of paper so that its base touches the back edge of the paper at one point (5). Place the paper on the corner of the desk, *next* in front, or next to the right across the aisle (one's own desk is too near). Turn the paper so that its back edge appears horizontal.

(*b*) Determine the proportions of the cone and place points on the paper indicating the whole width (3–4), and height (1–2).

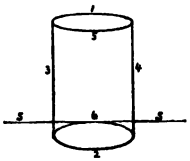
(*c*) Hold the wire so that it appears to cover the shelf-line. (That is, in this case, the back edge of the paper on which the cone rests.) Sketch this (*s*–*s*). This locates the back edge of the base (5).

(*d*) Sketch the base entire; sketch the elements of the cone.

(*e*) Correct if necessary, and erase all construction lines, including the back edge of the base.

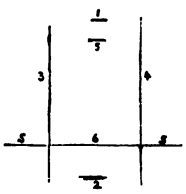
(*f*) Line-in, as usual, being careful to make no break or corner in the lines at 3 and 4.

The Cylinder. — This combines the two previous conditions, and furnishes opportunity for the pupil to discover another axiom of model drawing; namely, a change in level changes the apparent foreshortening of a surface.[1]



(*a*) Place a $2'' \times 4''$ cylinder as the cone was placed.

(*b*) Indicate its whole height (1–2); and its whole width (3–4); thus: —



(*c*) Locate the nearest point in the top face (5), and the shelf-line (*s*–*s*).

Notice that the distance 1–5 is less than 6–2, because the top face is nearer the level of the eye than is the bottom face.

(*d*) Sketch the ellipses.

(*e*) Correct and erase all construction or guide lines.

(*f*) Line-in, as usual.

II. *Single Objects.*

NOTE. — Object drawing shows the application of principles learned in model drawing. Intelligent practice should give facility in drawing, and will lead to a love for natural beauty, to an appreciation of artistic representation, and to some knowledge of pictorial composition and pictorial art.

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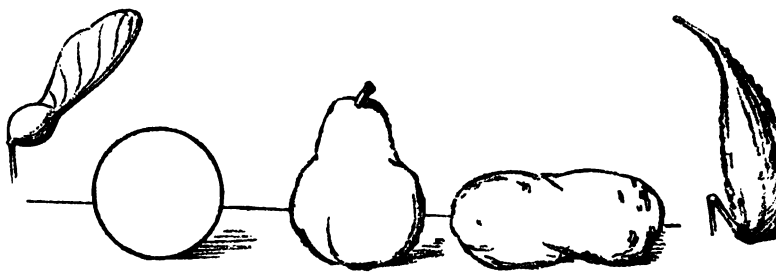
[1] This lesson may well be preceded by a special exercise on the effect of a change in level. A large pasteboard circle or a hoop held at different levels is a good object to illustrate the lesson.

1. *Applications of the Hemisphere.* — Steps to be taken by the pupil: —
   (*a*) Having selected a suitable object, place it at the back edge of the desk, directly in front of the pupils who are drawing it.
   (*b*) Study the object, comparing it with its type solid; determine its proportions, and how it shall be placed upon the paper.
   (*c*) Indicate on the paper its width and height.
   (*d*) Sketch the ground line, or shelf line.
   (*e*) Sketch the outlines.
   (*f*) Sketch important, characteristic details.
   (*g*) Correct if necessary.
   (*h*) Line-in with lines expressive of the character of the object.

2. *Applications of the Cone.*

3. *Applications of the Cylinder.*
   In all these the steps are precisely similar to those already given.

NOTE. — *On Character of Line.* While it may not be possible in this grade to get much "feeling" into the drawings, the pupils should at least know something of the "handling" required to produce the effect of difference in texture. These different handlings can hardly be described, but they may be illustrated.

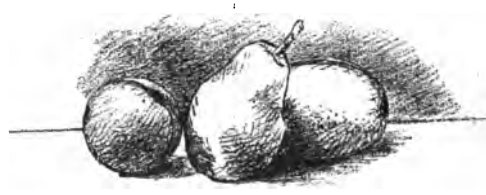


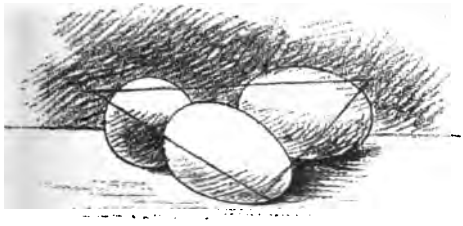
Generally speaking, a delicate line (1) indicates thinness and delicacy of structure; an even, rather narrow, gray line (2) indicates contours of objects having smooth even surfaces; broken gray lines of different strengths (3, 4) indicate irregular and rough surfaces; broad gray lines (5) almost invariably give the

effect of very rough or woolly or fuzzy surfaces. But after all no fixed rules can be established for the use of lines to give texture. If the artist *thinks* texture while drawing, his lines will show it. If he admires a peculiar kind of line and always uses that, his drawings will be prudish and conventional.

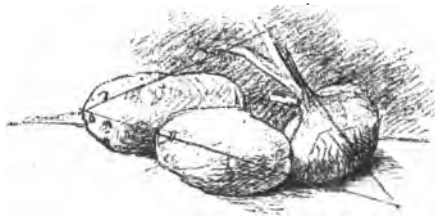
III. *Groups.*

NOTE. — Pictorial composition, or grouping, is the art of arranging objects in a picture to suggest a story pleasantly. A mere collection of objects is not necessarily a group; they must be arranged with reference to some one principal object, occupying the most prominent position, to which all the others are accessory, simply leading up to the principal. For example, in the group of fruit at the right the pear is the *principal* object, the others are *accessory*.





The objects should be placed so that the eye may comprehend the whole group at once, without being attracted successively by different accessories. As a rule, avoid parallel lines in grouping; that is, do not place all objects at the same apparent level, nor allow long lines in two adjacent objects to have the same direction. Generally, the most satisfactory groups are triangular in mass, as shown in the accompanying illustrations.



1. *Groups of Models.* — Steps to be taken by the pupil: —
   (*a*) Arrange a group, observing the simple rules of composition. (See foregoing note.)

(*b*) Indicate on the paper extreme width and height of group.

(*c*) Sketch the entire mass of the group.

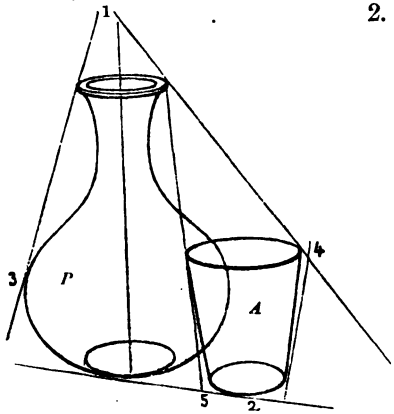
(*d*) Determine and indicate the relative positions and sizes of individual objects.

(*e*) Sketch each object in mass.

(*f*) Correct, if necessary.

(*g*) Draw carefully the principal object.

(*h*) Draw the accessories.



2. *Groups of Objects.* — The steps are the same as in sketching a group of models: Whole height, 1–2; whole width, 3–4; entire mass, 1–3–2–4; relative masses of objects, 5–2–4 and 1–3–5; sketching principal object, *P*; and accessory object, *A*. In finishing such groups, give most attention to the principal object, bringing out clearly its important and characteristic marks. Emphasize only essential details.

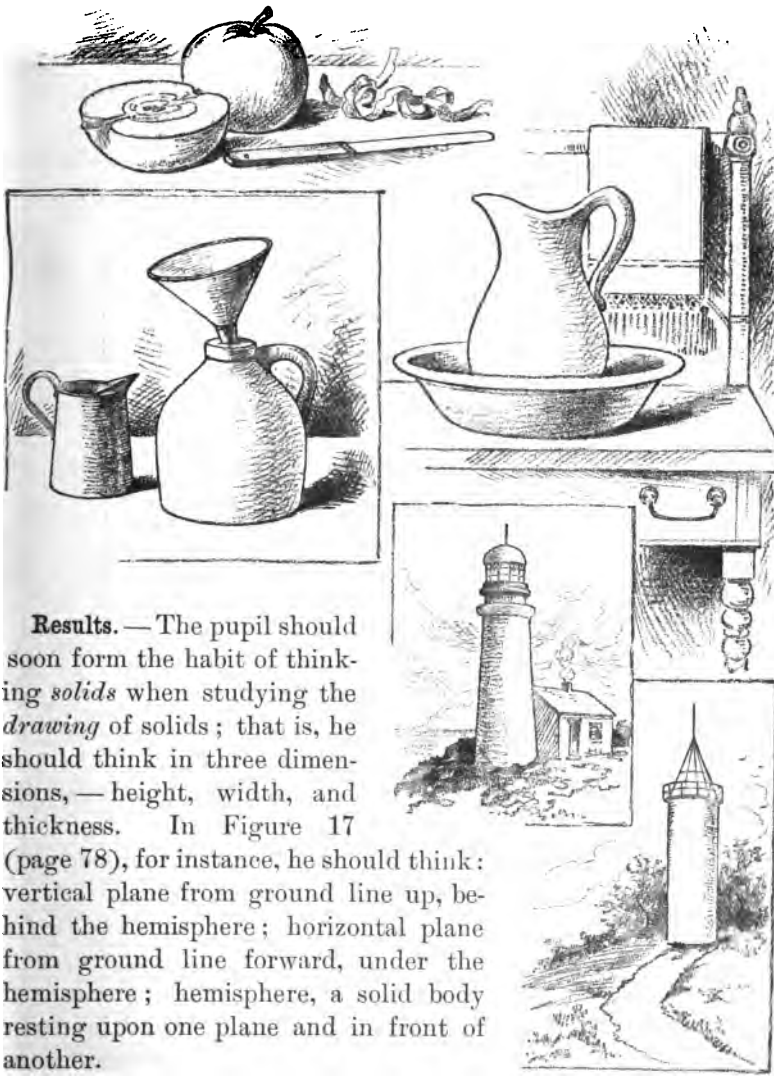
NOTE. — Be sure to sketch *each* object entire, visible and invisible parts, to insure room for each object to stand in its proper position on the ground. Unless this is done, two adjacent objects are often drawn, occupying the same or parts of the same space! See Figures 24 and 29, page 80. In 29, the edge of the bowl may touch the pitcher, but it should not enter its side, as it must do unless sufficient room is allowed between their bases.

IV. *Sketching from Nature.*

The pupils of the fifth grade in school are far enough advanced to do considerable outdoor sketching. Each should be supplied with a little sketch-book of manilla paper, and encouraged to use it constantly.

At first, the pupil may find it best to sketch such natural forms as may be suggested by his school work; but later, any object or group which attracts attention as pleasing — such, for example, as those here shown — may be attempted. Select simple subjects; do not be too ambitious at first.

The same steps are to be taken in outdoor sketching that were taken in the schoolroom when sketching from objects. Practice will secure good results.

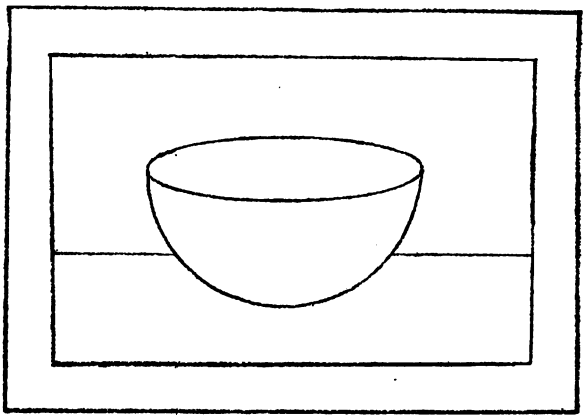


Results. — The pupil should soon form the habit of thinking *solids* when studying the *drawing* of solids; that is, he should think in three dimensions, — height, width, and thickness. In Figure 17 (page 78), for instance, he should think: vertical plane from ground line up, behind the hemisphere; horizontal plane from ground line forward, under the hemisphere; hemisphere, a solid body resting upon one plane and in front of another.

The page in the drawing book may be arranged as in Figure 17. The outside oblong represents the edges of the page; the inner oblong is the margin line. A hemisphere is represented. In every case the margin lines and ground line should be drawn, as well as the object.

In object drawing, the fewest possible number of lines should be used to graphically represent the object. No line should be meaningless; if it is so, it should not appear.

Many simple, thoughtful drawings are better than one or two laboriously finished to the finest detail. A simple drawing



17

roughly executed may show the *character* of the object, and that is of more importance than any particular detail.

In objects and groups a suggestion of light and shade may be added. (See illustrations on page 77.)

Encourage sketching in connection with work in Language, History, Geography, and Nature Studies.

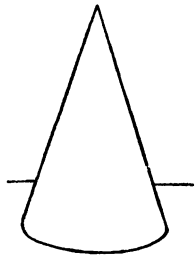
Show the pupils examples of good pictorial art, photographs of historic buildings and their ornament, examples of carved and molded enrichment, vases, and other beautiful forms. If a museum of art is in the vicinity, visit it often, and lead the pupils to love and look for the beautiful in all things.

ILLUSTRATIONS.

(Drawing Book V., pages 25 and 26.)

Type Solids.

17. A hemisphere (inserted on page 78).
18. A cone standing on its base, below the level of the eye.
19. A cylinder similarly placed.



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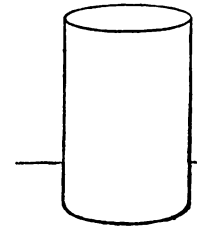

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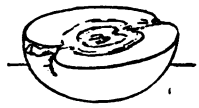
Applications.



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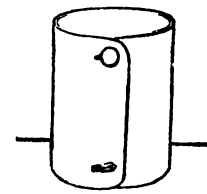
21

20. A half-apple.

21. A Japanese bowl.

22



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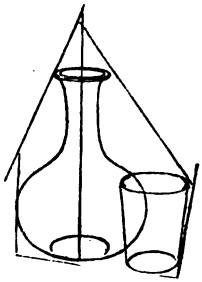
22. A cornucopia.

23. A cuff.

Groups.



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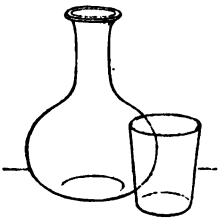

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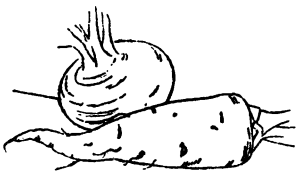
24, 25. A water bottle and glass.

26



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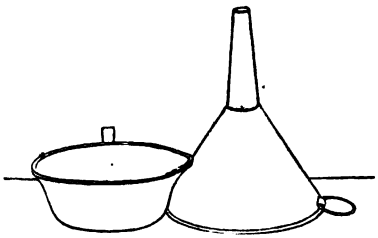
26. A group of fruit, — apple and half-apple.
27. A group of vegetables, — parsnip and turnip.



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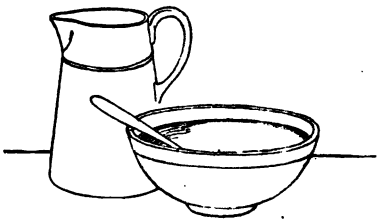


29

28. Kitchen utensils, — a saucepan and tunnel.
29. Bread-and-milk set, — milk-pitcher, bowl, and spoon.

BLACKBOARD ILLUSTRATIVE SKETCHING.

INTRODUCTION.

THE power to illustrate lessons by sketches upon the blackboard is now not only recognized as important to the teacher, but even essential. Number, reading, language, plant, and animal lessons in primary grades, and geography, history, zoölogy, and botany lessons in grammar grades, may be properly accompanied by blackboard sketches.

Illustrations help the word descriptions by addressing the mind through one more avenue — that of sight. They add interest to a lesson, and gain involuntary attention from the pupils; and that which is listened to with interest makes a deeper impression upon the mind.

Blackboard sketching in light and shade is a very simple thing when considered intelligently; and an enthusiastic teacher, who is willing to try, will find that she can accomplish much with but little effort.

The sketches on the plates following page 90 are mainly limited to such illustrations as will be found useful in the lessons on Pictorial Drawing; but there are also sketches which will indicate how fully lessons in physical geography can be illustrated.

Teachers and pupils should make collections of pictures, illustrating lessons in the year's course, and mount them on cards, or in scrapbooks, for future use or reference. They should make original illustrations of a simple character for lessons that are given in their classes. By drawing these on blackboard paper, they can be preserved for future use.

EXERCISES ON STRAIGHT LINES.

(See Illustrations, Plate I.)

In rapid and effective sketching, the side of the crayon should be used, as this produces broad marks of various widths, (according to the angle at which it is placed with the direction of the marks,) to which the texture of the blackboard gives the desired transparency.

Directions of Strokes. — Use common crayon of medium softness. Allow the body to be poised naturally, keep erect and at arm's length from the board. Each stroke should be produced by a free movement from the shoulder, without bending the arm at the elbow. Bearing firmly upon the board with the side of the chalk, and beginning at a convenient height above the level of the shoulder, draw, with an even pressure, vertical strokes of a foot or more in length. Repeat the exercise until vertical strokes can be executed easily and rapidly.

Horizontal Strokes. — Hold the crayon in a vertical position, bear on firmly, and make the strokes with a steady motion from left to right, using the side of the crayon.

Oblique Strokes. — In drawing from the upper right to the lower left, stand a little to the left of the drawing. In drawing from the upper left to the lower right, stand to the right of the drawing. Draw with a steady, even motion, secured by a firm pressure of the chalk upon the board.

The above exercises can be immediately applied in the following simple objects, represented by *combinations of straight lines:* —

The Brick Wall. — This is but a series of horizontal marks of the same size, each representing a brick. Use the side of the chalk for the width of the brick, and draw the stroke for its length in proportion. Draw a few irregular lines to represent a vine growing on the wall, and some suggestive marks about an inch in length and of irregular shape for leaves. The grass at the foot of the wall is drawn with the side of the chalk by apparently careless lines, generally in an oblique direction. For drawing leaves and grasses no definite directions can be given. Study the illustration for further aid.

The Well. — Draw three broad parallel horizontal strokes quite near each other, to represent the boards, then two narrow vertical strokes at the ends of the horizontal ones. Draw the chain or rope by a simple, straight vertical line of proportionate length; mark its fastening to the well-sweep; then draw the upright support with the side of a shorter piece of crayon, breaking the stroke in its course by different pressures. Draw some irregular marks, suggestive of weeds and grasses, as indicated in the illustration. Study the illustration for handling and simplicity of treatment; try to produce similar effects, and especially avoid overworking the drawing.

The Ladder. — The wall against which it leans should be drawn first. The two upright sides of the ladder are next drawn with a crayon of proper length

to produce a mark of the desired width. The cross rounds or steps should each be drawn at one stroke, and narrower than the side pieces. Imagine a branch of a tree bending downward, and sketch broken oblique lines for the branch and twigs. Draw marks as before directed, to give the appearance of leaves. It is not necessary to follow the illustrations closely, for the object is to obtain facility in handling the crayon, the illustrations being for practice only. Do not attempt to copy much detail.

The Fence.—Draw in succession a series of parallel vertical strokes of the same width and length; then add the two horizontal strokes for the rails, to which the slats are fastened. If the slats have pointed ends, draw the triangular end with the side of the chalk, at one stroke, beginning at the point.

The Dog Kennel. — This drawing requires an even balance from the center of the roof. The angle representing the end of the roof is drawn first, then the vertical strokes to represent the boards, and then the horizontal stroke for the base or platform. All the vertical strokes are drawn in succession to the same ground level, and the arched space for the entrance is made by erasing as much of the drawing as is necessary.

The Gate. — Draw all the vertical strokes to represent the slats; then draw the upper and lower horizontal strokes for the rails, then the oblique brace. Draw one more broad vertical stroke to represent the side of the fence to which it is fastened.

EXERCISES ON CURVED LINES.

(See Illustrations, Plate II.)

The Circle. — The simplest curves are arcs of the circle. For freedom in executing the circle the following directions are given: Stand at a moderate distance from the board — at arm's length away from it is best for some drawings, which position also allows the pupils to see the work; stand firmly on both feet, poise the body properly, stretch the arm out directly towards the board at about the level of the shoulder, and let this point be the center of the circle to be drawn. From this position, move the arm to the left, to the right, above and below, as far as it will conveniently reach. Having thus determined the trace of the circle to be drawn, rotate the arm from left to right with a slow, even motion, gradually increasing the speed of the rotation but keeping it regular. Finally, without breaking the continued motion, let the chalk trace the circle. This method of drawing a circle is almost purely mechanical, and will be found to give truer results and to take less time than any other.

The Ellipse. — Draw a circle by the method previously described and continue the motion, gradually lessening or flattening the curve on two opposite sides. These curves, if drawn with a free motion, will be good elliptical curves, having more feeling in their outlines than those drawn on axes. See Illustrations.

The Sphere. — The circle is the basis of all spherical forms. Draw the circular outline, using the side of the chalk. Draw the area of high light with

broad parallel strokes, gradually diminishing the pressure, so that the tone naturally loses itself in that of the blackboard. Draw the reflected light directly opposite the high light. The clouds are drawn with the same circular motion, sometimes conflicting with and hiding parts of outlines already drawn. More natural effects may be produced when the chalk is handled lightly throughout, with only an emphatic stroke here and there for high light.

The Tomato. — This is based on the flat spheroid, outline for which is an ellipse. Draw this and then the outline of the segment. Press evenly and regularly with the side of the chalk, for the effect of light and high light on the left side. Draw the calyx with a single irregular mark for each sepal. Add the stem.

The Watermelon. — This may be represented by a series of ellipses. It should be practiced on the blackboard full size. Draw the outer ellipse first, then narrower ones to represent the markings. Represent the stem by one emphatic stroke with the side of the chalk.

The Apple, etc. — Small spherical forms are drawn by producing both outline and shaded surface by one stroke with the side of the chalk.

The Jardinière. — Draw a large ellipse to represent the entire contour of the jardinière. On its upper outline, draw a smaller ellipse for the mouth. The flutings are broad and rounded above, tapering toward the base; each may be made by one heavy stroke, gradually diminishing the pressure towards the tapering end. The flutings should appear to lessen in width to the left and right.

Arcs of Circles, applied in the drawing of *ferns* and *leaves*. Draw a circle with a free arm movement, and, beginning at any point within the circle and near its circumference, draw a set of connected arcs (as seen in the Illustrations), with a forward and backward movement, without lifting the chalk from the board, gradually decreasing the length of the strokes towards the center of the circle. Practice these connected arcs in various positions.

The Clump of Ferns. — These are drawn with the same free backward and forward motion with the side of the chalk, the forward strokes being more emphatic than the return strokes. Begin with the base of the fern, gradually shortening the strokes towards the apex. To give effects of light, press more heavily at the beginning of each stroke. The grouping of the whole and the position of each fern must be studied from nature. A few lines representing grasses may be added.

The Palm Tree. — Draw the trunk of the tree with the side of the chalk, making a broken, uneven stroke to represent the rough appearance left by the persistent bases of the leaf-stalks. The leaves of the palm are usually many cleft, and to represent them use the same stroke as that for ferns. In drawing the crown of the tree, turn some of the leaves from us, some toward us, some to the left, and others to the right. Draw those turned from us indistinctly, and those in front with clearness. Connect the palms with the ground line by herbs and grasses.

THE HALF-SPHERE AND OBJECTS BASED ON THE HALF-SPHERE.

(See Illustrations, Plate III.)

NOTE. — The sketches on Plates III., IV., and V., are to accompany lessons in Pictorial Drawing on geometric type solids, and may be either drawn on the blackboard by the children or the teacher previous to the lessons, or rapidly sketched by the teacher during the lessons, when objects that resemble these geometric type solids are mentioned. The objects should also be present, so that the pupils will not fail to understand that the geometric type solids form the basis of, and their drawing aids in the representation of, all objects.

The Half-sphere. — Draw the outline of the sphere with a circular motion, producing the circle at once without break in the line. (See illustration, Plate II.) Bisect the circle by a horizontal diameter. Study the model of the half-sphere, and observe the appearance of the circular plane face, when viewed from the side. Practice the ellipse. (See illustration, Plate II.) Draw the ellipse, making it of its apparent proportions, on the diameter of the circle, and erase the upper half-circle. Give the effect of solidity by light and shade, as seen on the object.

The Half-apple. — Draw a circle, a diameter slightly oblique from the horizontal, and an ellipse upon this diameter for the view of the cross-cut or plane surface of the half-apple. Erase the upper half-circle; modify one end of the ellipse for the necessary representation of the blossom end, and the other end of the ellipse for the stem. Draw the stem, and irregular broken curves for the outlines of the core showing the carpels; then draw the seeds with two or three emphatic marks. Represent any characteristic markings such as stripes and spots, and show the light and shade as seen in the object.

Mushrooms. — Draw a few circles of various sizes, and develop views of half-spheres from them by light and shade. Add the stalks, and a few marks to represent the ground. Study the illustration, if specimens cannot easily be obtained.

The Bird's Nest. — Draw a series of ellipses in horizontal position in rapid succession. (See Plate II.) Choose the ones best fitted to represent the hemispherical form of the nest. Cover the whole surface of the outside with marks long and short, intersecting and mingling in such a manner that the character of the surface of the nest is represented. The object will best suggest how this should be done. Add the high light to the rim to give the appearance of relief. The forked branch of the tree, upon which the bird's nest rests, can be drawn without direction.

The Horse-chestnut. — Draw a series of ellipses in a vertical position in rapid succession. (See Plate II.) Choose from them those that will best correspond to the outlines of the two halves of the chestnut burr, and erase the others. Draw the nut. Bring out the roundness of the burr by added pressure with the side of the chalk. Draw the prickles with short emphatic marks of

decreasing width and color; study the specimen to ascertain how to represent them; that is, those near the contours of the object should be in profile, and the others should be more or less foreshortened, according to their positions.

Coral. — The specimen represented is one of the Astræa tribe, and is almost hemispherical in shape. Observe the general shape of the specimen and sketch this, freely indicating irregularities in contour by short broken strokes made with the side of the chalk. Draw lines lightly indicating the outlines of the cups, then the radiate divisions in a few of these.

The Shell. — The specimen for observation is the common scallop shell, and although its shape is not as deep as a half-sphere, its contour when viewed from the side very nearly resembles ellipses. Draw two ellipses in a horizontal position in one continued motion, the lower one showing the lower outline of the shell extending a little to the right of the ellipse representing the outline of the interior. Draw the radiate markings with strokes that are very emphatic on the margin of the shell, where they represent the scallops, but gradually decrease in strength toward the beak. Represent the outside of the shell more definitely; to do this give a whiter effect with a greater pressure of the crayon. The direction of the stroke should be from the margin of the shell, curving downward toward the lower outline; the stroke should meet the lower outline tangentially, and should, if continued, reach the part of the shell near the beak.

The Basket. — Draw a circle, and bisect it horizontally. Draw an ellipse to represent the rim of the basket, when viewed from the side. Study the web of the basket and represent it characteristically, remembering that all lines parallel to the rim must be drawn in harmony with the curve of its ellipse. The longitudinal divisions will appear to decrease in width as they approach the left and right outlines, and must be so drawn. Finish the half-circular handle according to the character of the object studied.

The Gas Light, Bracket, and Globe. — Draw a vertical straight line for the side of the wall, then draw the outline of the bracket, and last the globe. The globe, being of glass, should receive but little shading.

The Silver Cake Basket and **the Twine Holder.** — First represent the half-spherical outlines, then draw the stands. A little of the decorative detail, as seen in the objects, may be added to finish.

Instead of these, other objects of similar shape and character may be used for study, according to convenience or preference.

THE CONE AND OBJECTS BASED ON THE CONE.

(See Illustrations, Plate IV.)

The Cone. — Study the cone standing on its base; compare its height with the width of its base; determine its shape, noting the size of the angle made by the sloping sides. Draw this angle with free motions and artistic gray lines, using the side of the crayon, and study the poise of the sketch, comparing it with that of the cone. Sketch a straight line at such distance from the vertex

of the angle drawn, as will make an isosceles triangle of the proper size and shape for the cone. The sketch, so far, is the blocking out of the cone. Study the outline of the base, and if it shows as a curved line, notice the degree of the curve. Observe that the union of the slanting sides with the base of the cone at the left and right does not appear abrupt, but the lines pass into each other without break. Then draw the outline of the base, making light trial curves tangential to the slanting lines of the sides. Again study the cone attentively, and observe whether the drawing represents the cone's outlines correctly. Criticise the *balance* of the drawing; that is, a line drawn from the apex perpendicular to the base should cut the drawing into two similar parts. Notice whether the points of union of the base with the sides are tangential. The student should practice drawing ellipses and straight lines tangential to them, to gain facility in making tangential union between straight and curved lines.

This method of drawing the cone may also be followed when drawing it in any other position.

Light and Shade. — Place the cone so that it will receive light from the left; study the appearance of the light area and of the part in shade; observe the high light, and the reflected light, and compare the latter with the former. Notice that both light and shade broaden with the shape of the cone from apex to base. After this study, lay on the light part strongly with the side of the chalk, then the reflected light, then emphasize the high light. The shade is represented by the blackboard. The light and shade will now be quite disconnected and harsh. In order to blend them pass lightly with the side of the chalk over the whole surface of the cone. (See Plate IV.) Do not try for any special effect of texture, but let the grain of the board give the right transparency to the strokes.

Practice the cone in the other two positions shown on Plate IV., and also in other positions with the axis at varying angles.

The Cornucopia. — Compare the cornucopia with the cone, and sketch it, using the same method as given for the cone. (*a*) Compare the length of the cornucopia with the width of the opening. (*b*) Study the slant of sides from the apex to the mouth. (*c*) Sketch lines representing the sides. (*d*) Determine the length of the cornucopia, and draw a horizontal line, thus making an isosceles triangle, or blocking out the cornucopia. (*e*) Study the apparent width of the mouth and particularly the curve of the near outline, and sketch the ellipse representing this, making it tangential to the sides.

If the cornucopia is closed, the effect of the twisted paper cover can be given by means of a very few strokes. The ribbon handle can be drawn with one almost straight stroke, slanting, of course, toward the point of support. This is not shown in the illustration, as the twigs and needles of the fir tree do not allow the handle to hang naturally. Add the decoration as upon the model studied.

The Shell — Spotted Subula. — (If this specimen cannot be obtained, any other with an equally conical spire will answer.) Observe the shape of the shell, and represent the general taper of the sides from the apex to the body of

the shell by two light uniform strokes with the side of the crayon. Observe that the body approaches an ovoidal form, tapering toward the beak. Sketch the outlines of the body and beak of the shell.

Notice the gradual increase in the width of the whorls from the apex to the beak of the shell, and the curve or direction of the sutures dividing the whorls. Draw each whorl with one stroke of the side of the crayon, pressing more heavily on the surface of high light; add the bands of spotted markings. Represent any detail necessary to give character to the sketch.

The Parsnip. — Choose a large specimen for study. Place it in a position that will best represent it, and sketch its general shape — that of a cone — with such irregular broken lines as its contour requires. Study the light parts, represent these with boldness and emphasis; add root fibers, leaf-stalk, and leaf.

The Electric Light Shade. — Study the proportions of the shade from the object, noting the slant of the sides and the appearance of its circular rim. Draw the parts in the following order: (*a*) The two slanting sides. (*b*) The elliptical rim. (*c*) The electric wire. (*d*) The fixtures — collar, socket, and switch. (*e*) The bulb. The light and shade of this illustration show the effect made when the light is turned on.

The Pine Tree and Mountain. — Study the illustration, and observe the difference in the strength of the tones; the distant mountain is only lightly indicated, the near mountain at the right is more emphasized, and the trees in the foreground at the left are very pronounced. The tree is the principal conical object. Draw a vertical stroke for the trunk, and irregular oblique lines for the branches. The sketch of the pine branch in the illustration of the cornucopia on the same plate will give some idea of the proper treatment of the branches; this illustration, together with a cut branch and a preliminary study of the pine tree, should enable the student to make a successful sketch.

The Volcano. — Draw gently slanting uneven gray lines for the slopes of the volcano, and a horizontal line for the base. Cover the surface of the mountain lightly with the side of the crayon. (See sketch, Plate IV.) Mark the outline of the crater by a broken, firm white stroke, and with the side of the crayon represent the clouds of smoke as broad gray masses, having a luminous white effect near the crater. Draw light gray vertical strokes for the rain of ashes; light gray horizontal ones for the lake or sea at the base of the mountain. Show the reflection of the volcano in the lake, by emphasizing the lines representing the water according to the position of the light.

The Funnel, Vase, and **Trumpets** vary so little from the shape of the cone, that they will not require separate descriptions.

THE CYLINDER AND OBJECTS BASED ON THE CYLINDER.

(See Illustrations, Plate V.)

The Cylinder. — Study the model of the cylinder to discover proportionate dimensions. Draw two vertical lines of indefinite length to represent its width.

If the cylinder is standing on an end, and a view of the upper circular end is seen, determine the width of the ellipse to represent it. Draw the ellipse in a horizontal position with a free, light outline, the ends being tangential to the two sides. Study the curve of the lower end and sketch the same, drawing trial lines lightly. Correct and finish with an even and more definite line. (The student should practice making the elliptical curves in two directions, as indicated by the arrows in the illustration, showing the outline drawing of the cylinder, on Plate V.)

Side Views of Circles. — The illustrations on Plate V. show the appearance of circles at different distances above and below the eye of the observer. Study circular objects in a horizontal position, on the level of the eye and above and below the level of the eye, and represent them in the positions seen. On the level of the eye, the circle will appear as a straight line; in any other position, it will appear as an ellipse; and the farther it is removed from the level of the eye, the wider will the ellipse appear.

Cylinders in Horizontal Positions. — The method of studying and drawing these is the same practically as that previously given for the cylinder.

The Round Tower. — Represent the width by two vertical lines, and the height by two horizontal lines cutting the vertical lines so as to make the width and height proportionate. This oblong is the blocking out of the tower. As the structure is built of rough stone, the vertical sides should be represented by broken lines. The upper outline should be an upward semi-elliptical curve, as it would thus appear seen from below. Using the side of the chalk, draw, with a firm pressure, short marks over the surface of the cylinder to represent the stones. The general direction of these marks must follow the curve of the upper outline. If this gives too set an effect, mark lightly over the entire surface of the tower with the side of the chalk to mass the quantities of light. Draw the arches, giving an effect of high light on the masonry, making the arches follow the elliptical curve of the base of the cylinder. Then represent the ground, using the side of the crayon, giving it as much character as possible.

The Lighthouse. — Make this of nearly cylindrical shape. If it is built of stone, give it the same general treatment as the Round Tower. Draw the mass of rocks with bold, strong strokes, making them sharp and angular. The horizon should be represented by a light, rather indistinct line; the clouds, by irregular curving outlines; and the little yachts, by emphatic white strokes.

Corinthian Columns. — Draw vertical lines for the columns, and within the sides draw vertical lines to represent the flutings, allowing these to become indistinct and to stop, as the illustrations are of imperfect and worn columns. The capitals indicate only slightly the acanthus foliage, as they are broken and covered with mosses and ivy. At the foot of the columns lie fragments of others. The illustrations may be studied to advantage with a reading-glass, which will magnify the columns and show the character of the strokes.

THE MOUNTAINS.

(See Illustrations, Plate VI.)

The sketches on this plate may be used for language or geography lessons. After the teacher has had the experience of drawing the illustrations given, others showing the different physical features of land will be found comparatively easy, even when engravings and woodcuts are used for copy. It must, however, be remembered, that in translating these into blackboard drawing, the lights and shades must not be reversed, and that if it becomes necessary to represent both light and dark masses with the crayon, the dark masses must be very faint and indistinctly gray, while the light masses should be brilliantly white.

If the following illustrations are used for practice exercises, they should not be copied in detail, but rendered very freely.

A full view of a great range of mountains stretching off in the distance presents to the beholder ever-varying effects of color and of light and gloom: at sunrise, the purple on the hills, the gigantic shadows, the conflict between the radiance on the summit and the dusk in the valley; at sunset, the glorious purple light dyed into the hills by the level rays of the sinking sun. This glory of coloring cannot, of course, be rendered with the crayon; even effects of light and shade can be but feebly shown. But the beauty and boldness of the conformation of the mountains can be represented very forcibly.

The Mountain Peak. — The sketch of the bald mountain peak, partly enveloped in clouds, will afford some suggestion for the treatment of light and shadow on the mountain. Draw the outline of the peak with irregular bold lines. Mass the light emphatically on the left slope. Leave the right side almost without chalk marks, the dark surface of the blackboard representing the shadow. Draw the clouds in curving outlines with the side of the chalk. If the texture is too rough, soften the effect by gently rubbing with the fingers.

The Ravine. — Study the illustration for planes of color or values. Observe that the precipitous mass on the right stands out in clear relief, and that the mountains on the left become indistinct as they recede. With the side of the crayon, draw the general masses of a light gray color. Add the contours and lines of fracture to give character to the sketch; then emphasize the parts standing in relief. With the edge of the eraser, erase a somewhat horizontal zigzag line of chalk in the lowland, to represent the stream flowing from the mountain side.

Mountain Ranges. — These, at first, may be broadly massed, drawing with the side of the crayon to produce an even effect of light, and bringing out the different peaks by additional emphatic strokes on their left slopes. The valleys may be left entirely covered with an even light gray tone, or a narrow river may be drawn, winding around the base of the mountains.

PLATE I.

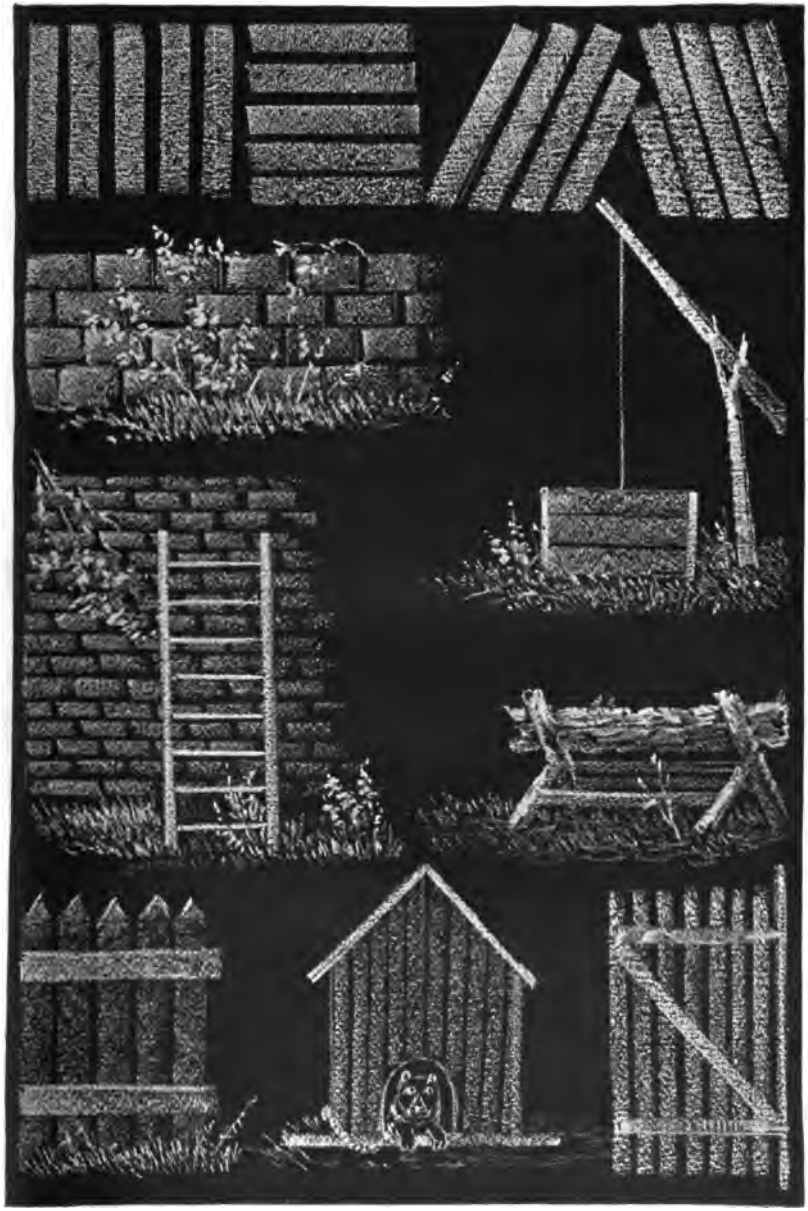


PLATE II.

PLATE III.

PLATE IV.

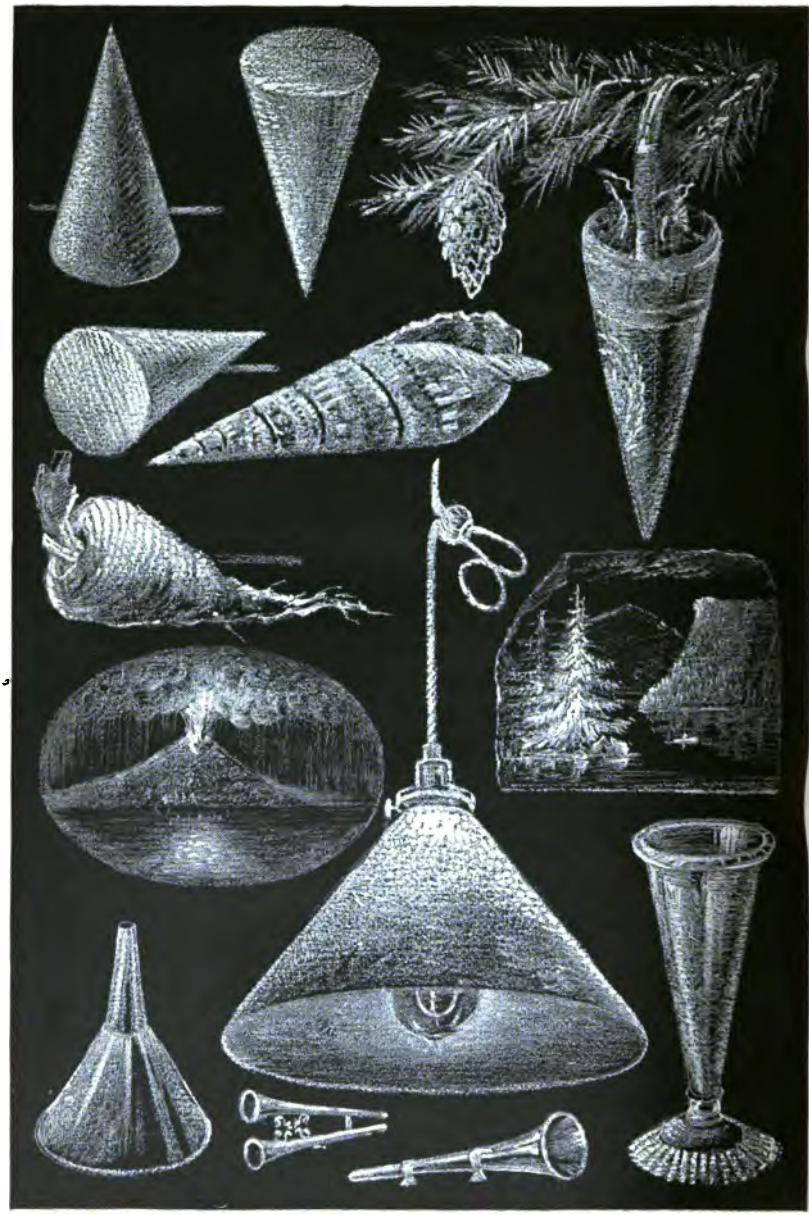


PLATE V.

PLATE VI.

ILLUSTRATED DEFINITIONS.

GEOMETRIC SOLIDS.

A Solid is space inclosed by surfaces — it has length, breadth, and thickness. In art, the term may be applied either to a model or an object.

Sphere. A solid bounded by one curved surface, every part of which is equidistant from its center. A solid formed by the revolution of a circle upon its diameter.

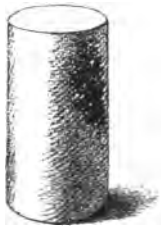
Hemisphere. Half a sphere. A solid obtained by bisecting a sphere with a plane passing through the center.

Spheroid. A curvilinear solid bounded by one curved surface, all plane sections of which are ellipses or circles.

Prolate Spheroid, Long Spheroid, or **Ellipsoid.** A curvilinear solid, formed by the revolution of an ellipse upon its major axis.

Oblate Spheroid or **Flat Spheroid.** A curvilinear solid formed by the revolution of an ellipse upon its minor axis.

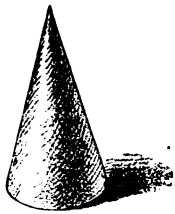
Ovoid. A solid having the form of an egg. A solid formed by the revolution of an oval upon its axis.



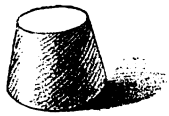
Cylinder. A roller-like body, with flat, circular ends. A solid formed by the revolution of a rectangle upon one of its diameters.

Half-cylinder. A solid formed by dividing a cylinder with a plane passing through its axis.

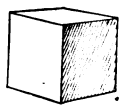
Circular Plinth. A very short cylinder. A cylinder in which the height is less than the diameter of its flat, circular faces.



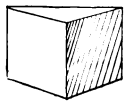
Cone. A solid having a circle for its base, and tapering to a point, or vertex. A solid formed by the revolution of an isosceles triangle upon its altitude.



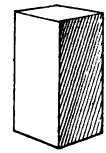
Circular Frustum. That part of a cone which remains when the top part is cut off by a plane parallel with its base.



Cube. A solid bounded by six equal square faces.

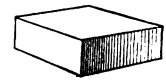


Half-cube. A solid formed by dividing a cube upon a diagonal of one face. A half-cube is a triangular prism.

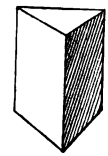


Prism. A solid whose ends are similar, equal, and parallel, and whose sides are parallelograms.

Square Prism. A prism whose ends are square.



Square Plinth. A very short square prism. A plinth in which the height is less than the diameter of the square faces.

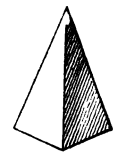


Triangular Prism. A prism whose ends are triangles.

Pentagonal Prism. A prism whose ends are pentagons.

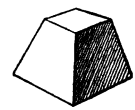
Hexagonal Prism. A prism whose ends are hexagons.

Octagonal Prism. A prism whose ends are octagons.



Pyramid. A solid having one base bounded by any number of straight lines, and having the same number of triangular faces with a common vertex.

Square Pyramid. A pyramid whose base is a square.



Square Frustum. That part of a square pyramid which remains, when the top part is cut off by a plane parallel with its base.

Triangular Pyramid. A pyramid whose base is a triangle.

Pentagonal Pyramid. A pyramid whose base is a pentagon.

Hexagonal Pyramid. A pyramid whose base is a hexagon.

Octagonal Pyramid. A pyramid whose base is an octagon.

Truncated Solid. That part of a cylinder, cone, prism, or pyramid, which remains, when the upper part is cut off by a plane at an oblique angle with the base.

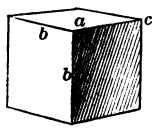
DETAILS OF SOLIDS.

Surface is the boundary of a solid; it has length and breadth, but no thickness. In art, the outside of a thing is considered its surface.

Face. A part of a solid (*a*) bounded by edges.

Edge. A part of a solid, where the surface abruptly changes its direction (*bb*). A part of a solid where two faces meet.

Outline. The line, real or apparent, by which a figure is defined.



Corner. A part of a solid (*c*), where three or more edges meet.

Point. A point has position only, without size; but in drawing it is indicated by a dot, and represents a corner, or marks position.

Line. The boundary of a face. A line has length only; but in drawing it is indicated by a fine mark of the pencil or crayon, and represents an edge or an outline.

Straight Line. A line which has the same direction throughout its length.

Curved Line. A line which constantly changes its direction throughout its length.

Broken Line. A line made up of very short straight lines or of dots.

NOTE. — When the word "line" is used alone, a straight line is meant.

Positions of Lines.

According to their positions, lines are *horizontal*, *vertical*, or *oblique*.

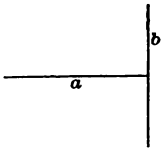
Horizontal Line. A line which is level.

In drawing, a line which extends directly toward the right and left of the page is said to be horizontal. Thus, *a* is a horizontal line.

Vertical Line. A line which is perpendicular to a horizontal.

In drawing, a line extending directly toward the top and bottom of the page is said to be vertical. Thus, *b* is a vertical line.

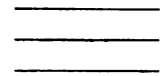
NOTE. — Vertical and perpendicular have not the same meaning. A *vertical* line always points up and down; but any line forming a right angle with another is *perpendicular* to that line, no matter what its direction may be. Thus, *a* is *perpendicular* to *b*, although not a *vertical* line.



Oblique Line. A line which is slanting to the right or left. Thus, *c* and *d* are oblique lines. If the upper end of the line leans toward the right, it is called a *right-oblique* line, as *d*; if toward the left, a *left-oblique* line, as *c*.

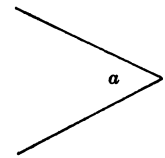
Relation of Lines.

In their relation to each other, lines may be *parallel* or *at an angle.*



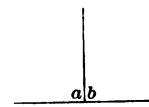
Parallel Lines. Two or more lines that are the same distance apart throughout their length.

Lines at an Angle. Lines that are not parallel.



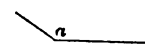
Angle. The difference in direction of two lines, which meet at a point, is called an angle. Thus, *a* is an angle.

Angles are divided according to the directions of their lines into *Right Angles* and *Oblique Angles.*

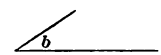


Right Angle. An angle formed by one line meeting another in such a way as to make the two adjacent angles equal. Thus, *a* and *b* are right angles. The lines forming these angles are *perpendicular.* (See note under "Vertical Line.")

Oblique Angles. All angles which are not right angles are oblique. Oblique angles are either *obtuse* or *acute.*



Obtuse Angle. An angle that is greater than a right angle. Thus, *a* is an obtuse angle.



Acute Angle. An angle that is less than a right angle. Thus, *b* is an acute angle.

NOTE. — The lines forming an angle are called its *sides;* the point at which they meet is called the *vertex* of the angle.

GEOMETRIC FIGURES.

Plane. A surface on any part of which a straight line may be drawn in any direction.

NOTE. — The top of the desk, if it can be imagined without thickness, may illustrate a plane.

Geometric or **Plane Figure.** A portion of a plane limited by lines.

Rectilinear Figure. A portion of a plane limited by straight lines.

Curvilinear Figure. A portion of a plane limited by curved lines.

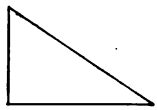
Mixtilinear Figure. A portion of a plane limited by both straight and curved lines.

RECTILINEAR PLANE FIGURES.

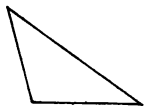
Triangles.

A Triangle is a plane figure having three sides and three angles.

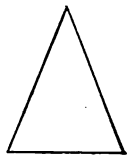
Triangles are divided into six classes: according to their angles, into *Right-angled, Obtuse-angled,* and *Acute-angled* Triangles; according to the relative lengths of their sides, into *Isosceles, Equilateral,* and *Scalene* Triangles.



Right-angled Triangle. A triangle having one right angle.



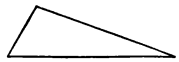
Obtuse-angled Triangle. A triangle having one obtuse angle.



Acute-angled Triangle. A triangle having all its angles acute.

Isosceles Triangle. A triangle having two of its sides equal.

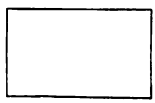
Equilateral Triangle. A triangle having all its sides equal.



Scalene Triangle. A triangle having no two of its sides equal.

NOTE. — Every triangle may have two names — one given it on account of its sides, the other on account of its angles. For example, an equilateral triangle is also an acute-angled triangle, for having three equal sides always gives it three acute angles.

Quadrilaterals.

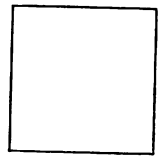


Quadrilateral. A plane figure having four sides.

Rectangle. A quadrilateral whose angles are all right angles.

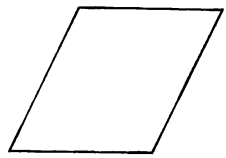
Rectangles are divided into *squares* and *oblongs.*

Square. A rectangle whose sides are equal.

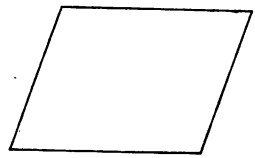


Oblong. A rectangle whose adjacent sides are unequal.

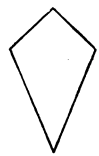
Rhombus. A quadrilateral whose sides are equal, two of its opposite angles being acute, and the other two obtuse. A *Diamond* is a rhombus.



Rhomboid. A quadrilateral whose angles are like those of a Rhombus, but only its opposite sides are equal.



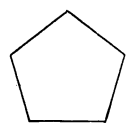
Trapezium. A quadrilateral no two of whose sides are parallel.



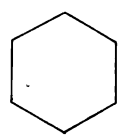
Polygons.

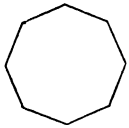
A Polygon is a rectilinear figure having more than four sides. When all the sides and angles of a polygon are equal, it is called a *regular polygon;* when the sides or angles are unequal, it is called an *irregular polygon.* Geometrically, triangles and quadrilaterals are frequently classed as polygons.

Regular Pentagon. A polygon having five equal sides and five equal angles.

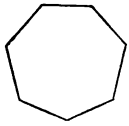


Regular Hexagon. A polygon having six equal sides and six equal angles.



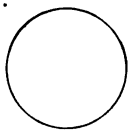


Regular Octagon. A polygon having eight equal sides and eight equal angles.



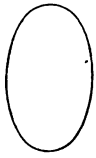
A polygon having seven sides is called a **Heptagon.**
A polygon having nine sides is called a **Nonagon.**
A polygon having ten sides is called a **Decagon.**
A polygon having eleven sides is called a **Undecagon.**
A polygon having twelve sides is called a **Dodecagon.**

CURVILINEAR PLANE FIGURES.



Circle. A plane figure bounded by a curved line, every part of which is equally distant from a point within called the center.

A *semicircle* is half a circle, and is obtained by cutting a circle on its diameter. It is a *mixtilinear* figure.



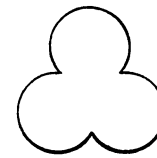
Ellipse. A plane figure, bounded by a regular curve, every point in the outline of which is at the same combined distance from the foci.

Oval. A plane figure similar in shape to the longitudinal section of a hen's egg.

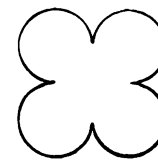
Crescent. A plane figure bounded by two curved lines, so arranged as to resemble the shape of the new moon.

Lens. A symmetrical plane figure bounded by two curved lines, curving in opposite directions.

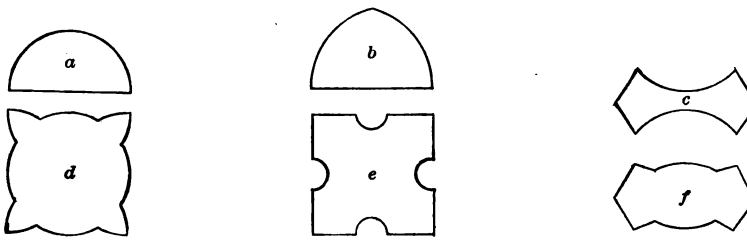
Trefoil. An ornamental figure of three foils or leaves, resembling a clover leaf.



Quatrefoil. An ornamental figure of four foils or leaves, resembling the petals of a flower.



MIXTILINEAR PLANE FIGURES.



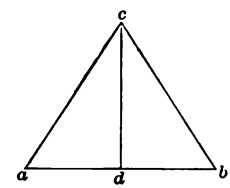
Of these there are, of course, an infinite number. They are used in art largely as inclosing forms for designs. The foregoing figures (*a*, *b*, *c*, *d*, *e*, *f*) illustrate these.

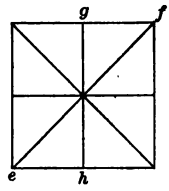
DETAILS OF GEOMETRIC FIGURES.

Base. That part of a rectilinear figure upon which it is supposed to rest, as *ab*.

Apex. The highest angle above the base, as *c*.

Altitude. The perpendicular distance from apex to base, as *cd*.





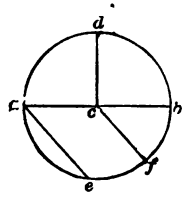
Axis. Any line which divides a symmetrical figure into two equal and similar parts, as *ef* or *gh*.

Diagonal. A line connecting opposite angles, as *ef*.

Diameter. A line connecting the centers of opposite sides of a plane figure, as *gh*.

Diameters are sometimes distinguished as *vertical* and *horizontal*.

Diameter of a Circle. A line drawn through its center, between opposite points in the circumference, as *ab*.



Radius of a Circle. The distance from the center of a circle to any point in the circumference, as *cd*.

Circumference. The unbroken line which bounds a curvilinear figure.

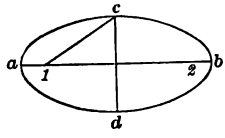
Arc. Any part of a curve, as *db* or *ef*.

Chord. A straight line connecting the extremities of an arc, as *ae*.

Segment. The space inclosed by an arc and its chord.

Sector. The space between any part of the circumference and two radii of a circle, as *bcf*.

Quadrant. The space inclosed by one quarter of the circumference and two radii of a circle, as *dcb*.

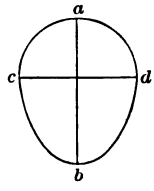


Long Diameter. The longest straight line which can be drawn in an ellipse, as *ab*.

Short Diameter. The shortest straight line which can be drawn in an ellipse, cutting the figure into two equal parts, as *cd*.

The long and short diameters of an ellipse are always perpendicular, and bisect mutually.

The terms *long* and *short diameter* are sometimes applied to the axis and the line representing the greatest width in an oval; as, long diameter *ab*, short diameter *cd*.



Foci. Points in an ellipse from which the curve may be drawn mechanically, as *1*, *2*. The distance from *c* to *1* always equals one half of *ab*.

MISCELLANEOUS TERMS.

Alternation. The repetition of one set of units separated by another set of units of a different character, in reciprocal succession.

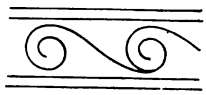
Axis of Symmetry. A line drawn through the middle of a figure, so that the parts on one side are exactly repeated in a reverse order on the other. The axis may be drawn in any direction, being governed by the character of the figure; in the ornamental figure next below, it is vertical.

Bisect. To divide into two equal parts.

Bisymmetrical Design. A symmetrical arrangement in which one half is the exact reverse of the other.

Blocking-in Lines. Sketched lines which indicate masses.

Border. An ornament which consists of a regular repetition of ornamental units, along a line of indefinite length. The cut shows a familiar Greek border, composed of scrolls or spirals.



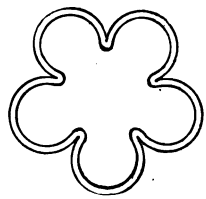
Botanical Drawing. The representation of plant form.

Center. A radial design.

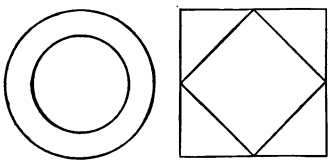
Center Line. A line representing the center of a solid.

Cinquefoil. An ornamental figure having five foils or lobes, often applied in windows, panels, etc.

Circle. In Christian art, a symbol of eternity.



Cinquefoil.

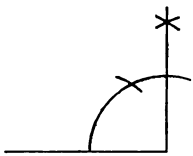


Concentric Circles and Squares.

Concentric. Having a common center.

Connecting Line. A line connecting similar parts in the drawings of two views of an object.

Construction. Making, or building; putting together the parts of any figure so as to give its peculiar form and structure. *Construction lines* are the framework upon which a drawing is made; they determine the distances, proportions, etc. *Construction*, as applied in geometrical problems, refers to the measurements and steps taken in the solution of the problems. The light lines in the cut show a method of construction in erecting a perpendicular at the end of a given line.

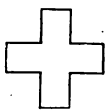


Contrast. The result of a juxtaposition of lines, forms, or colors of different characters.

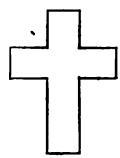
Contrasted Harmony. (See "Harmony of Color.")

Conventionalization. The modifying of natural forms in such a way that the principles of their growth are retained and unimportant details omitted or simplified. A conventional form is a form idealized according to the evident intent of nature.

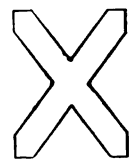
Cordate. Resembling a heart in outline.



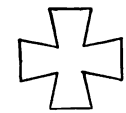
Greek Cross.



Latin Cross.

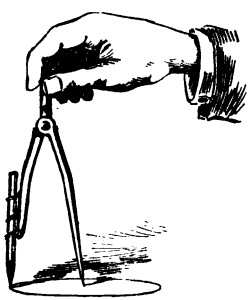


St. Andrew's Cross.



Maltese Cross.

Cross. Two bars placed transversely upon each other in various ways, each form having its own name. A symbol of suffering. Some of the more common crosses are shown in the illustrations.



Dashed Line. A series of dashes arranged in line. Invisible parts of objects are represented by dashed lines.

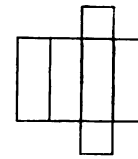
Describe a Circle. To draw with a compass. The accompanying cut shows the position of the hand, while describing a circle with the compass.

Design. The plan, combination, or arrangement of any construction or ornament for a given purpose, whether constructive

or decorative. The word is often misused to apply merely to ornamental subjects.

Detail. A selected part of a figure or object, usually drawn on a larger scale than is convenient for the whole.

Develop. To represent on a plane the entire surface of a figure.



Development. The entire *surface* of any solid or object when laid out upon one plane, as in the cut, which shows the development of a square prism. (See "Flat.")

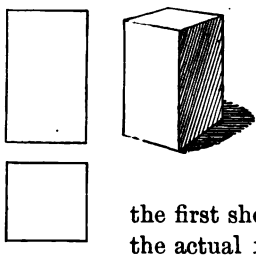
Diaper. A panel or flat, recessed surface covered with wrought work in low relief. (This form of decoration was used greatly by the Moorish artists for the enrichment of the walls of the Alhambra.) An all-over pattern.

Distribution. An orderly disposition of the units in the field of a design.

Dot-and-dash Line. A series of dots and dashes alternated in line. Center lines are drawn with dot-and-dash lines.

Dotted Line. A series of dots, or very short dashes, arranged in line. Connecting lines are drawn as dotted lines.

Elementary Design. A pleasing arrangement of units within a given form, based on certain recognized principles.



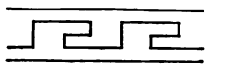
Elevation. A drawing giving the actual form and proportions of an object, as produced on one or more vertical planes. *Elevation* is opposed to *Plan*, which gives the actual form and proportion of an object as produced on a horizontal plane. Thus, in the three figures given the first shows the appearance of a prism, the *plan* shows the actual form and proportion of the base of the prism, and the *elevation* gives the form and proportion of one of the sides of the prism. Some objects require several different elevations, to show all the facts of form of all their details.

Field. That portion of any surface to be occupied by a design.

Flat. A development of the *whole* of an object; *e.g.*, the *flat* of a paper windmill is like a square with its diagonals.

Flat Ornament. An enrichment of a surface by means of contrast obtained by colors, or the use of light and dark.

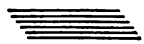
Fret. An ornament consisting of a series of lines or bands called *fillets*, which form a succession of angles, usually right angles, and are sometimes interlaced.



Full Line. A continuous line. Outlines and visible edges are always drawn with full lines.

Geometric Drawing. The drawing of lines, surfaces, and solids with instruments.

Ground. That upon which the object rests. The field of a design.



Half-tint. The darkening or shading of a surface, by means of a succession of parallel and equidistant lines, either vertical, horizontal, or oblique.

Harmony. Such an adaptation of the parts of a design to each other, that they form a complete and pleasing whole.

Harmony of Color. An arrangement of colors pleasing to a cultivated taste. There are five principal Harmonies: —

1. **Contrasted.** Composed of one color with neutrals.
2. **Dominant.** Composed of tones of color in one scale.
3. **Analogous.** Composed of colors from neighboring scales.
4. **Complementary.** Composed of colors which, when mingled, will produce white or gray.
5. **Perfected.** Usually composed of analogous or dominant combinations, with another color complementary to the prevailing tone.

Neutral colors may be added to all these combinations.

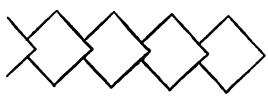
Hue. Any color found in the spectrum, except the six standard colors.

Mass. General shape, regardless of detail.

Neutral Color. A term used in decorative arts, to denote a color which has little or no effect upon the hue of a juxtaposed color. A neutral color is sometimes called a *passive color*.

The neutral colors are *white*, *gray*, and *black*.

Ornament. Any decoration or enrichment of form, color, or construction, intended to beautify an object.



Overlap.

Overlap. To lie over or upon. When a part of an ornament seems to lie upon another part, it is said to *overlap*.

Perspective. The science underlying the representation on a plane of any object exactly as it *appears* to the eye from one fixed point of view. The first cut under "Elevation" is a drawing *in perspective* of the prism represented.

Pictorial Drawing. A representation of the appearance of an object or group, as seen from one point of view.

Plan. A top view. (See "Elevation.")

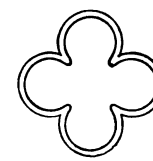
Plinth. A square member forming the lowest part of the base of a column; hence, any flat rectangular block, such as might be cut from a plank.

Proportional Measurement. A method of obtaining relative distances upon distant objects, by means of a pencil or similar implement.

Quadrisect. To divide into four equal parts.

Quality of a Color. The character of a color relatively considered. The quality of a color is said to be *warm*, when it approaches in appearance any of the colors in the red part of the spectrum; or *cold*, when it approaches in appearance any of the colors in the blue part of the spectrum. Colors acquire certain qualities by juxtaposition.

Quatrefoil. An ornament having four foils or lobes, often applied in panels, windows, etc. A symbol of the Evangelists.

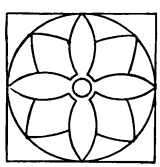


Quatrefoil.

Radiation. A method of arrangement in ornamental design, in which the parts diverge from a point. The *rosette* shown in the figure below is an example of radiation from a center. The horse-chestnut leaflets radiate from a point not in the center.

Repetition. An arrangement in which a number of similar forms or objects are placed in a row, or arranged round a center or over a surface.

Representation. Delineation by means of lines, light and shade, or color. All drawing is representation.



Rhythm. Repetition with accent. The frequent recurrence of some characteristic in the various parts of a design, without being obtrusive.

Rosette. A radiating ornament made of petal-like parts.

Scale of Color. The entire range of tones, from white, through its tints, a standard or hue, and its shades, to black.

Spectrum. A band of colors, produced by allowing rays of sunlight to pass through a triangular prism of glass, or other refracting medium. The spectrum contains red, orange, yellow, green, blue, and violet, usually called the *standard*, or *primary*, colors, and an indeterminate number of intermediate hues.

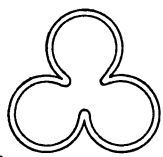
Standard Color. One of the six primary colors of the spectrum. A standard pigment color is one which imitates one of these, as closely as possible.

Symmetry. The result of a proper disposition and proportion of the parts of a design, forming a complete whole or unit.

Tangent. Touching at a single point. A line touching a curve which, even when produced, does not intersect it.

Tint. A color produced by adding light, or white, to a standard or hue.

Tone. One color in a scale of colors. Tone is also used to describe the general effect produced by any combination of colors.



Trefoil.

Trefoil. An ornament of three foils or lobes, often applied in panels, windows, etc. A symbol of the Trinity.

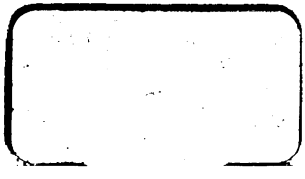
Trisect. To divide into three equal parts.

Unit of Design. One of the distinct fractions, or parts, of a design, repeated uniformly to complete the figure. One of the spirals in the design under "Border" is the *unit of design*, which, repeated, makes the completed figure shown.

Unity. Such a combination of parts as to constitute a complete and pleasing whole. The result of uniformity in the character of the main lines or units in a design.

Value. In color, the power or force of a color upon the eye. It is directly proportional to the amount of light the color reflects.

Variety. The result of variation, or difference, in the details of a design, without affecting its unity.

View. A term used to indicate the standpoint of the observer, when making a drawing of an object, as the *end view*, when only the end is seen.

Working Drawings. Drawings which represent facts of form; drawings from which objects may be accurately made or constructed. In making a working drawing, the eye is supposed to be opposite each part of the object represented.